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Light and Lighting

XXIX.—No. 1. January, 1936
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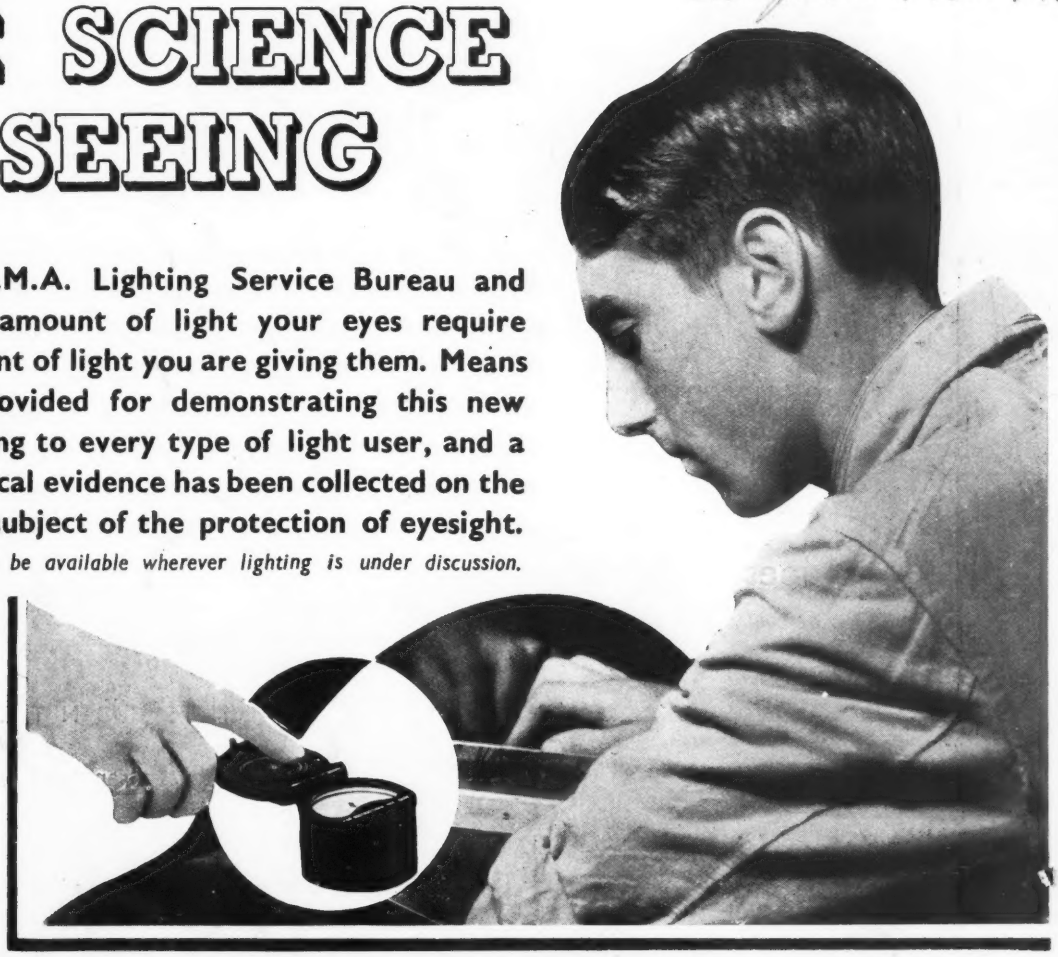
Complete 1 Vol 1 Book

THE SCIENCE OF SEEING

Visit the E.L.M.A. Lighting Service Bureau and compare the amount of light your eyes require with the amount of light you are giving them. Means have been provided for demonstrating this new science of seeing to every type of light user, and a mass of statistical evidence has been collected on the all-important subject of the protection of eyesight.

A light meter should be available wherever lighting is under discussion.



Light acts as a magnifier of fine detail. Good lighting in works ensures accuracy and promotes a cheerful atmosphere among the operatives

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British Made Lamps: OSRAM·MAZDA EDISWAN·SIEMENS·COSMOS·CRYSELCO

INCORPORATING "THE ILLUMINATING ENGINEER"

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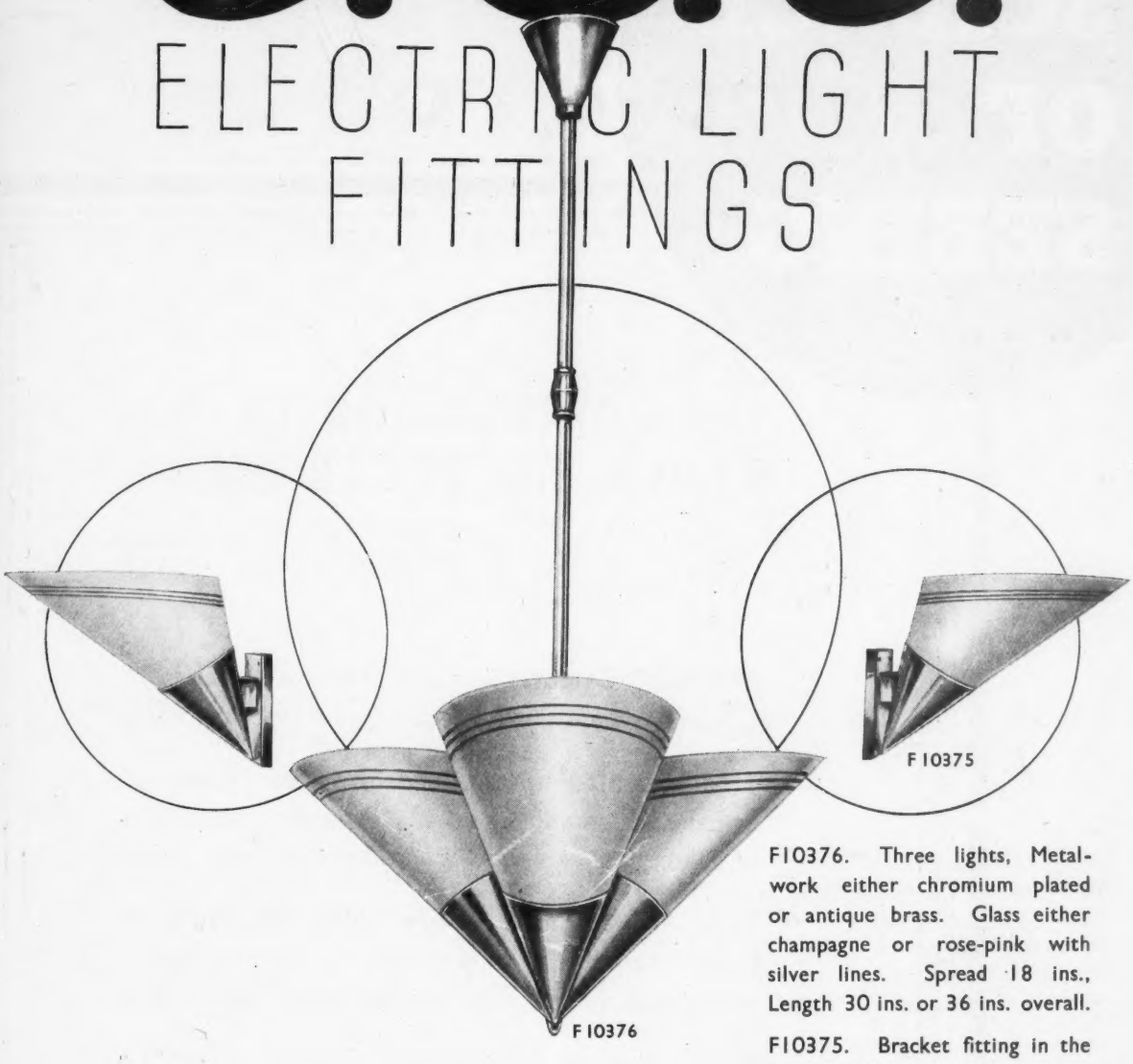

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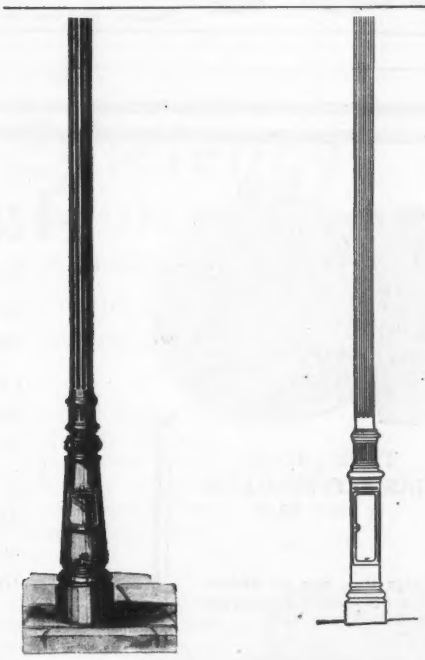

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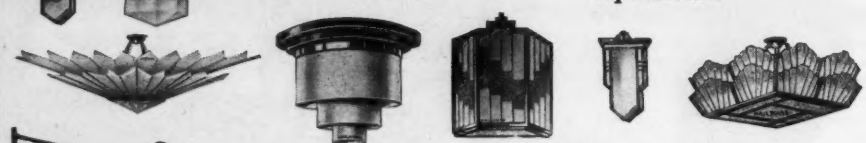

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Specialists in the manufacture of beautiful modern lighting glassware and fittings, table and standard lamps and advertising signs. Have you seen our new season's decorated shades? We shall be glad to send you particulars.

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Careful thought and experience in design, the best of British workmanship and materials, allied to the most up-to-date production and inspection methods, result in the utmost efficiency from Newbridge auto-lighters.

Many thousands are installed in all parts of the world, and satisfied users will gladly testify to the excellent results achieved.

Save the capital cost of converting indoor lighting to electricity by installing

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GAS SWITCHES

Write for details.

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GAS CONTROLLERS
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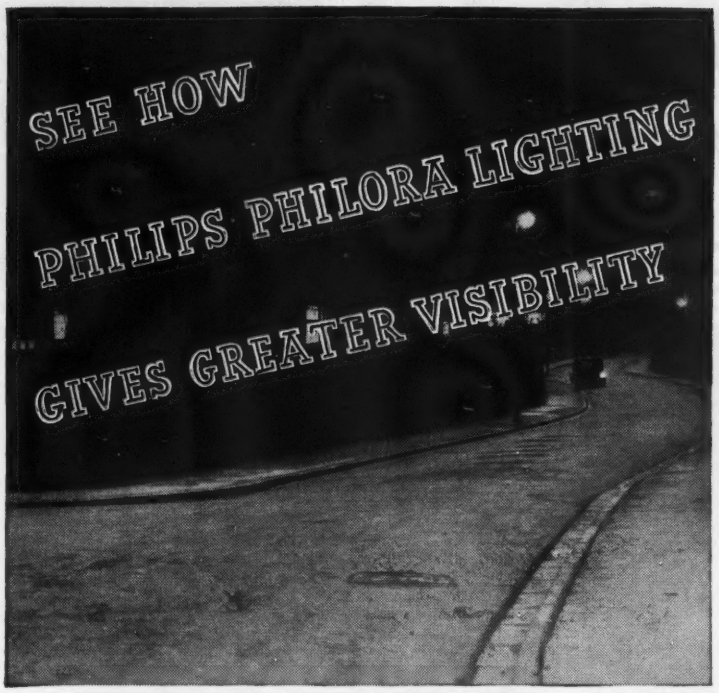
They sell because they excel

Let us submit samples for test under actual working conditions, together with quotation and catalogue.

THE HORSTMANN GEAR COMPANY LTD., Newbridge Works, BATH



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Says the Daily Express in its campaign against the Death Trap Roads of Britain.

Philips Philora Lighting is acknowledged as the safest and most efficient in existence. It is particularly remarkable for its evenness and freedom from glare, resulting in greatly increased visibility. Yet the current consumption of Philips Philora lamps is very low– often amounting to a considerable decrease in operating costs.

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SODIUM LIGHTING & MERCURY LIGHTING

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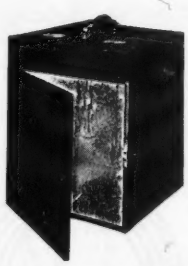
Here are two EVERETT EDGCUMBE Instruments

EVERETT EDGCUMBE make a complete range of PHOTOMETERS in laboratory and portable forms and every type of electrical measuring instrument used in photometry. Two representative types are illustrated.



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The " LUMEN-CUBE " is a handy portable instrument for demonstrating the efficiency of lamps to purchasers, and for general testing. The Lumen meter, indicating the output of the lamp, is conveniently placed on the top of the case, together with a Watt meter, which at the same time indicates the power consumption.

The " AUTO-PHOTOMETER " embodies a constant " autophotic " cell forming the test surface, together with a sensitive direct-reading illumination indicator of the moving-coil type. It can be used by anyone without previous experience, and is always ready for use. No battery, comparison lamp or other accessories are employed.

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Write for particulars :

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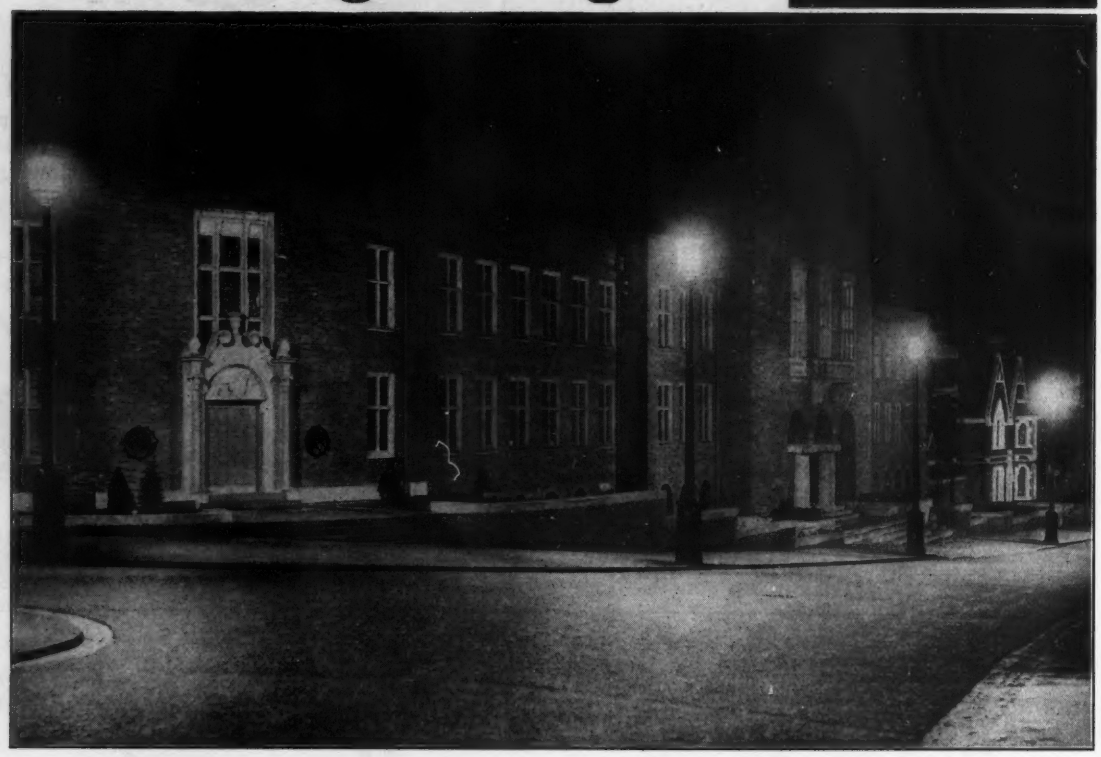
Manufacturers of all kinds of indicating and recording instruments, and photometer experts

Another outstanding example of REVO Street Lighting ..



REVO FITTING No. C9038.

Lighting the Priory Street and New Street frontages of Dudley's Municipal Buildings

Once more this progressive Midland borough has chosen REVO equipment for the lighting of the streets adjacent to its new Municipal Buildings.

The picture reproduced above speaks volumes for the lighting efficiency of the equipment, whilst the severely decorative design of the standards and lanterns is fully in keeping with the architectural characteristics of the buildings.

Whatever the scheme—there is REVO equipment to suit it. Why not let REVO engineers "throw some light" on your problems?

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LIGHTING EQUIPMENT

Made by REVO ELECTRIC Co., Ltd., TIPTON, Staffs.

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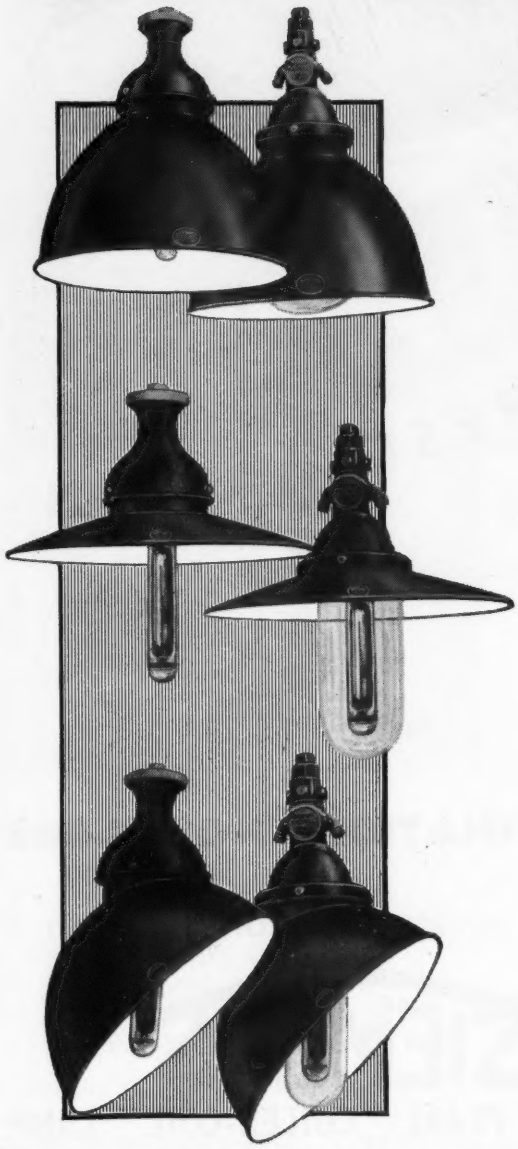

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2 Ranges.

INDOOR RANGE (PROTECTED BY PATENTS). Incorporates the Benjamin SAAFLUX system of easy wiring, cool insulation, and rapid detachability of lamp and reflector as one unit. Special spun top canopy, "CRYSTEEL" Vitreous enamelled reflector and SAAFLUX Goliath Edison Screw Lampholder.

OUTDOOR RANGE (PROTECTED BY PATENTS). Particularly robust design and construction for use in the most exposed locations. Heavy cast patented canopy with novel anti-condensation device, easy wiring and erection facilities and an inspection chamber for wiring. Easily detachable reflector with "CRYSTEEL" Vitreous enamelled finish, heavy screw-neck heat-resisting well-glass and all-porcelain skirted Goliath Edison Screw Lampholder.

3 Types.

DISPERSIVE TYPE.
For spacing one and one-half times the height above working plane, the main distribution of light being up to 65 degrees from the vertical.

DISTRIBUTING TYPE.
For spacing twice the height above working plane. Provides wide lateral distribution up to 85 degrees from the vertical.

PARABOLIC ANGLE TYPE.
For the lighting of vertical surfaces from the side, main distribution of light being from 0 to 90 degrees in front of reflector.

2 Sizes.

The complete range of both indoor and outdoor types is available in two sizes, the smaller for use with the 250 watt and the larger for 400 watt Electric Discharge Lamps.

This range of fittings has been developed in collaboration with, and has been approved by, the five British Makers of Electric Discharge Lamps. *Send for interesting leaflet.*

BENJAMIN REFLECTORS *for*

ELECTRIC DISCHARGE LAMPS

TARIFF ROAD : : TOTTENHAM : : LONDON : : N.17

SIEMENS STUDY LAMP

FOR EYESIGHT PRESERVATION

Scientifically designed in accordance with the requirements defined by the **E.L.M.A. Lighting Service Bureau** in its **"Science of Seeing"** investigations.

HIGH INTENSITY of ILLUMINATION—NO GLARE

Specially constructed for use with a

SIEMENS

100 watt PEARL "COILED-COIL" LAMP

this Study Lamp is a real necessity for Close Work such as Reading, Needle Work, Homework, etc.

For full particulars see List No. 499.

Better Light - Better Sight

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Incorporating "The Illuminating Engineer."

Light and Lighting

Official Journal of the Illuminating Engineering Society.

32, Victoria St., London, S.W.1.

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Telephone: Victoria 5215

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What About The Lighting?

THIS year, by all accounts, is to be marked by vast Public Expenditure.

It has been announced that:—

£50,000,000 is to be spent by the L.C.C. on a vast **Rehousing** Scheme in the East End.

£30,000,000, provided by a State-supported Loan, to be used by the **Railways** on Improvements in Rails and Rolling Stock, Electrification, Extension of Services, etc.

£100,000,000 is to be consumed in a Five Year Plan for **Road Improvement.**

Is there any way of ensuring that in these vast schemes **Improvement in Lighting** will not be overlooked?

On many railway stations throughout the country great improvements in lighting might be made—with advantage both to the companies and the public. The work of the M.O.T. Street Lighting Committee has already shown how much needs to be done in regard to the Lighting of the Roads.

Some means of impressing those who handle the allocation of these vast sums is needed. The "Council for the Lighting Industry," visualised by Mr. Beuttell, would have been just the body to undertake the task.

In the meantime cannot the Illuminating Engineering Society give the industry a lead?

Does the Consumer Know Best?—Floodlighting Without Fuss—Public Lamp Standards 30 Inches High—Illuminating Engineering in Australia—Up-to-date Lighting in a Sewage Works—Should Films Be Shown in Complete Darkness ?—The New Lighting Bureau of Scotland, etc.

Does The Consumer Know Best?

This might have been a more provoking title for the discussion at the very jolly informal meeting organised by the Illuminating Engineering Society in November last. Most speakers were only too painfully conscious that the consumer *does* have the last word, in the sense that he provides the cash. One fancies, however, that what the organisers of the meeting really had in mind was whether the user's judgment was as good or better than that of the expert. Surely this is not *always* or even *often* true—but it is true *sometimes*, and is often *partly true*. It is this that differentiates illuminating engineering from mechanical or electrical engineering, or other expert vocations which deal primarily with formulae and materials. In illuminating engineering one has to consider so constantly the human element—and that makes all the difference!

Floodlighting Without Fuss

Although not much has been heard of floodlighting developments recently—little, at least in comparison with the publicity given to the many striking installations during the King's Silver Jubilee—modest efforts in this direction are constantly being made. Such efforts should not be disregarded, especially in view of the fact that they represent practical attempts under everyday conditions—something different from spectacular efforts on festive occasions, which are necessarily costly and comparatively rarely attempted. A case in point is afforded by the subdued but effective lighting of the front of St. Martin-in-the-Fields (London) by means of several projectors, concealed behind the stone portico under the roof, which show up the columns in silhouette. Much of this everyday floodlighting surely does not demand a concentrated beam of light, and should therefore be done almost as easily with gas as with electric light.

Forthcoming Events.

Jan. 7th.* **Informal Visit** to the **Demonstration Theatre** of the Strand Electric and Engineering Co., Ltd., 27, Floral Street, London, W.C. *(Members wishing to attend should inform Mr. L. G. Applebee at the above address; Tel. Temple Bar 7464);* **6 p.m.**

Jan 14th. Mr. F. E. Lamplough on **Applications of Ultra Violet Light** and **Fluorescence and Phosphorescence.** *(Discussion illustrated by Experiments; General Meeting of the Illuminating Engineering Society to be held at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1);* **6.30 p.m.**

Jan. 21st. Mr. A. G. Brown and Mr. A. L. Whittenham on **"The World's Most Modern Fish Dock."** *(Meeting of the North-Western Area Local Section of the Illuminating Engineering Society at the Engineers' Club, Albert Square, Manchester.)*

Jan. 28th.* Dr. J. W. T. Walsh will deliver an **Introductory Address** at the First Meeting of the Special Section on Photometry of the Illuminating Engineering Society. *(Meeting at the Westminster Technical Institute, Vincent Square, London, S.W.1; those interested should inform Mr. K. F. Sawyer, Watson House, Nine Elms Lane, London, S.W.8);* **6.30 p.m.**

Feb. 4th. **The Annual Dinner** of the Illuminating Engineering Society at the Trocadero Restaurant, Piccadilly Circus, London, S.W.1; **7 for 7.30 p.m.**

*No cards will be issued for these two events.

Public Lamp Standards 30 Inches High

We are indebted to Captain W. J. Liberty for a description of a new street lighting device, attributed to Mr. Edwin Jones, of Liverpool, which is based on the use of a special reflector incorporating two parabolic surfaces, one to project a long-distance beam, the other to give width. It is stated that trials of the device were recently made before the Hoylake Urban District Council. A single reflector equipped with a 100-watt lamp is stated to have a range of fifty yards and a spread up to thirty yards, according to the mounting height, which, however, is intended to be relatively small—only about thirty inches! It is the inventor's belief that road surfaces can be most effectively illuminated by a lighting unit placed only a small distance above them. The method should have the advantage of eliminating glare, as the actual source can presumably be completely screened from the eyes of drivers and pedestrians; but it could presumably only form the sole method of lighting in cases where the brightness of the roadway, as distinct from surroundings, was the main consideration.

Pedestrians Must Carry Lamps!

The idea that pedestrians should be compelled to carry lights has often been suggested in fun. Now, one hears, this is seriously proposed in the case of unlighted highways in Normandy and forms the subject of a new official ruling by the Seine Inferieure Prefecture.

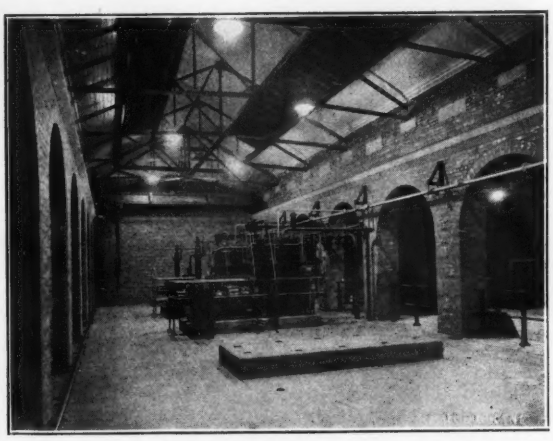
Illuminating Engineering in Australia

From the annual report of the Illuminating Engineering Society of Australia, it is evident that the society is holding its own. Its total membership (118) now includes ten sustaining members. In this matter a hint has doubtless been taken from the methods of our own society, and likewise in the establishment of a display night, when sustaining members are invited to exhibit new lighting equipment. In another respect, the holding of joint meetings with kindred bodies, the societies in England and in Australia are in line. During the session seven papers were read. Most of these dealt with lighting technicalities, but two of them, "The History of the Telescope," by Mr. James Nangle, the Government Astronomer, and "The Camera in the Service of Man," by Mr. B. A. Minto, indicate a broad view of subject matter, which is by no means a bad thing.

London's New Tower of Learning

It has recently been stated that the tower that will dominate the new London University buildings in Bloomsbury will be 210 ft. high—70 ft. higher than that of the Shell Mex building and 40 ft. higher than Nelson's Column. Special sanction has been received from the L.C.C. thus to exceed the limits of the present Building Acts. The tower will have eight storeys, to be used primarily in connection with the library. It should be an outstanding landmark in London and should prove an excellent subject for floodlighting. Although it is understood that the whole tower will not be completed before 1937, it is not too early for some enterprising firm in the lighting industry to take advantage of this hint.

Up-to-Date Lighting in a Sewage Disposal Works



The two pictures above illustrate the new electrical installation at the Knostrop Sewage Works of the Leeds Corporation, for which Messrs. Green and Smith, Electrical Contractors (Leeds), were responsible. The lighting scheme was prepared by Holophane, Ltd., in conjunction with this firm. All lighting fittings were supplied by Holophane, Ltd., and the electrical equipment by the Sun Electric Co., Ltd.

The treatment of the liquid sludge and its ultimate compression into a species of "cake" (sold to farmers and rhubarb growers) is quite a complex process. The wiring installation had to meet special requirements and there were various lighting problems to overcome. One of these was to illuminate satisfactorily the tops of the press plates in the Press House when the sheet steel covers were raised to their maximum extent. Accordingly a combination of vertical and horizontal lighting, by means of the lanterns suspended from the roof trusses and special wall reflector lanterns fixed on the walls at a suitable height, was provided.

Again, in the sludge loading room under the Press House, which is only 9 ft. high, there is very heavy girder construction and stanchions, also deep shutes for loading purposes.

Holophane 60-watt "Widerlite" fittings were mounted on the stanchions and walls, and gave excellent results, a feature being the absence of troublesome shadows. With the thirty-six fittings the wattage per sq. ft. is slightly under 0.3.

Perception of Outline and Judgment of Light and Shade

Dr. Lythgoe's recent paper before the Illuminating Engineering Society offered many plums for the picking. One marks especially his comment that the two processes named above are by no means the same nor affected in the same way by rising illumination. So far as visual acuity—the observation of shapes and outlines—is concerned, the higher the illumination the better, and this seems to apply to most visual processes. But in the task of distinguishing small changes in brightness the eye seems to be at its best with a relatively moderate brightness, 3 " equivalent foot-candles." One gathers that an inspector in a laundry, watching for faint spots on a snow-white surface, would be best suited with an illumination of about 3 foot-candles and might be actually handicapped by very much higher values. This is a conclusion which certainly " gives furiously to think."

Reversed Contrast

Another lesson from the paper, the highly prejudicial effect of " reversed contrasts " (i.e., contrasts unfavourable to perception of the object viewed) ought surely to be familiar, though it is often strangely disregarded in practice. To look for small changes in a very dark surface, surrounded by a mass of much lighter and brighter material, is a hopeless task. Yet this is exactly the experience of a worker on black cloth in a workroom lighted in the conventional approved manner, i.e., by overhead units with a white ceiling and walls of light texture—both ever so much brighter than the worker's material. The remedy, of course, is not to blacken the walls but to moderate the general illumination and then to give very strong local light on the actual work, which should be the brightest thing in view.

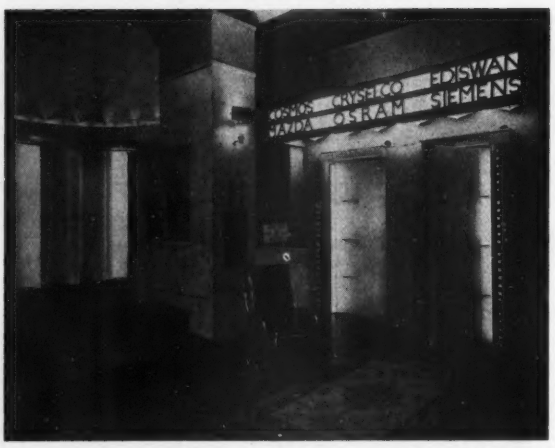
Should Films be Shown in Complete Darkness?

Even when the contrast is in the right direction, that is to say the object looked at is much brighter than its surround, the contrast may be carried too far. Although cinema theatres habitually show films in almost total darkness it is very doubtful whether this is necessary or even expedient. Excessive contrast between the bright screen and the surroundings is undesirable aesthetically and is doubtless fatiguing to the eyes. Pictures might often be shown with a general illumination much higher than is usual at present, and with a lighter surround so that the step-down from the brightness of the picture is more gradual. Such moderate general illumination could usually be contrived without the stray light falling on the screen and impairing the picture. But some consider that the degree of contrast exhibited in films goes beyond that characteristic of natural conditions and can be reduced with advantage. We have in mind a demonstration in the Holophane Laboratory when mild coloured light was deliberately superimposed over the image on the screen, which did not seem to suffer as a result, but was rather enhanced in appearance.

Studying the Stratosphere

The recent balloon expedition into the stratosphere, undertaken by Captain Anderson and Captain Albert Stevens on behalf of the United States, established a new record of altitude, fourteen miles, and will doubtless yield much interesting scientific information, for example in connection with the much-discussed " cosmic rays." Investigators in this field have learned from experience. One question of moment is the colour of the exterior surface of the gondola. Originally this was painted dead black, but absorbed the sun's rays so fully as to become unpleasantly hot. Professor Picard accordingly painted the surface white—with the result that he suffered intensely from the cold! Recent investigators have apparently adopted an intermediate course.

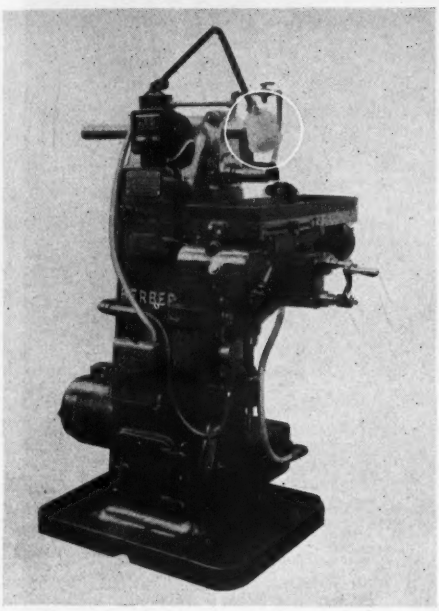
The New Lighting Service Bureau of Scotland



A View of a Section of the Bureau.

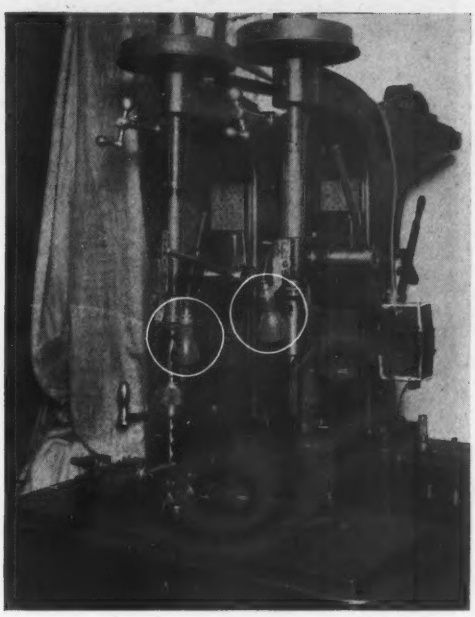
After having served a very useful purpose for two years the showrooms of the Lighting Service Bureau of Scotland at 29, St. Vincent-place, Glasgow, have been completely reconstructed. New features include a range of fourteen types of lighting fittings covering industrial and commercial requirements. A " luminous grill " composed of shapes representing hearts and spades (in which lamps concealed behind the spades illuminate the hearts, which have been surfaced with vermilion paint) has been prepared. The grill also admits daylight and serves to suggest methods of combining light and decoration in restaurants, cinemas, theatres, and shops. Examples of direct, semi-indirect, and indirect lighting systems are on view and the possibilities of architectural tubular lamps are well illustrated.

A feature, also, is the demonstration of architectural lighting. Illuminated curtains, doors, and canopies fit into the general scheme of decoration in green, pink, and bronze. Lighting equipment is built into specially prepared false walls. The utility of the Bureau has been considerably enhanced by these new departures, and we do not doubt that full use will be made of the unique opportunities for demonstration which it affords.



LOCAL LIGHTING RETURNS

Low Tension Miniature Units (picked out in each picture by means of a white ring), supplied from storage batteries or transformers, are incorporated in the design of the machine.



In the days of the "industrial revolution" of the past century it was quite usual for each worker to have his own primitive light. Indeed, as researches in the Midlands have shown, this condition is occasionally found even to-day—for example, amongst certain classes of tenement workers where candles may still form the sole illuminant.

This individual lighting came to be superseded more by general lighting as the cost of light was diminished and more efficient illuminants were introduced. In the present century it has become quite usual to provide general overhead lighting of say 5 to 10 foot-candles, and considerably higher values are found in many factories of to-day.

It would seem, however, that a third stage is being reached. There are certain tasks for which general lighting alone is not very suitable, either because a very high illumination is needed or because the direction from which the light comes is important. This applies particularly to very accurate work on small objects and dark materials.

In such cases it is now becoming usual to adopt a special miniature lighting unit, e.g., a 12 volt "omnibus" type of lamp in a reflector little larger than an egg-cup, which can be brought within a few inches of the point of work and thus provide an intense local illumination of 100 foot-candles or more. Such units are now being actually "built in" so as to form part of the framework of certain types of machines. Some examples were described by Mr. E. W. Murray at a recent meeting of the Illuminating Engineering Society, and they may be seen in operation at the Home Office Industrial Museum (Westminster).

One warning may be given—such special lighting is admirable for certain jobs but does not render moderate general illumination unnecessary, severe contrasts between the bright object and dark surroundings are bound to fatigue the eyes. The aim should be, therefore, first to provide reasonably good general illumination throughout the shop and then to add the extra "super illumination" at the point of work.

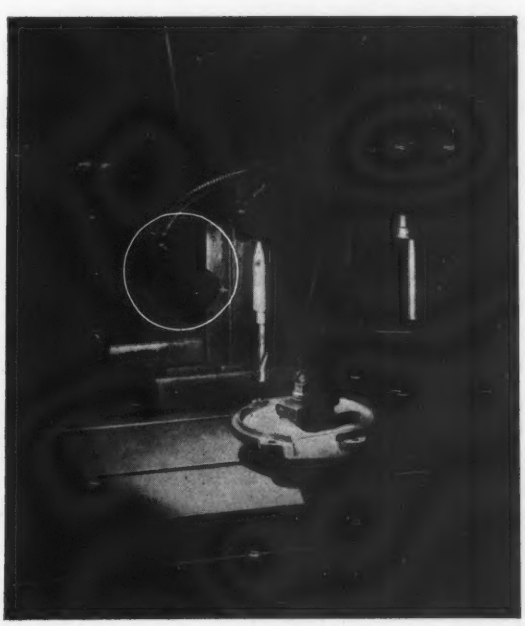


Fig. 1. A View of the New Restaurant of Messrs. Robinson and Cleaver, Ltd. (London), illuminated by a pleasing combination of direct and indirect methods.

MODERN STORE LIGHTING

Relighting of the Premises of Robinson and Cleaver, Ltd. (London),

by

Waldo Maitland

THE new lighting of these premises may be regarded as typical of the good results attending the combination of scientific methods of illumination with good architectural design.

The New Restaurant.

A few words may first be said in regard to the lighting of the new restaurant, a view of which appears above (Fig. 1). The lighting of this restaurant is effected by the use of both indirect and direct methods. The direct lighting takes the form of five suspended wall brackets, each containing architectural tubes, enclosed in a pleated Rodoid shade.

The indirect lighting is by means of thirty reflectors, spaced 1 ft. 6 in. apart in a trough, supported by two mirrored columns. Each reflector contains a lamp of 60 watts and provides a uniform distribution of light over the curved ceiling. The use of a trough was the outcome of the existence of two isolated columns, and although several schemes were considered, the final arrangement provided the most homogeneous design. The lighting of the counter (Fig. 2) is effected by a series of reflector units placed some two feet apart behind a wood valance.

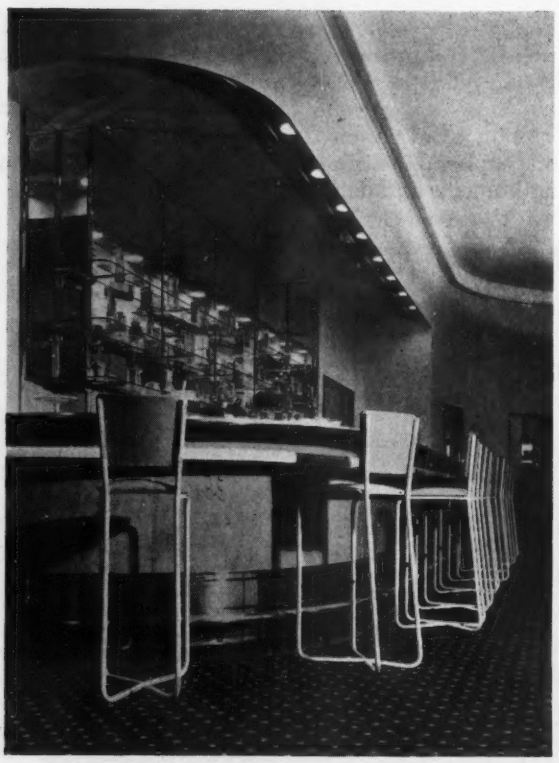


Fig. 2. Counter Lighting in the Restaurant by reflector units placed 2 ft. apart behind a wood valance.

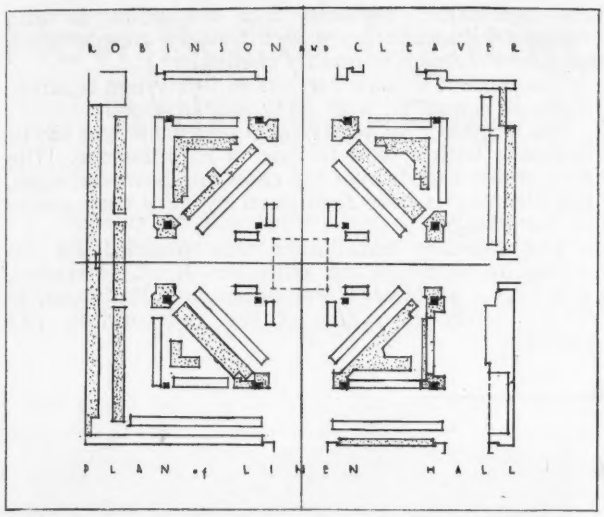


Fig. 3. (N.B.—The shaded portion of the plan indicates unlighted showcases.)

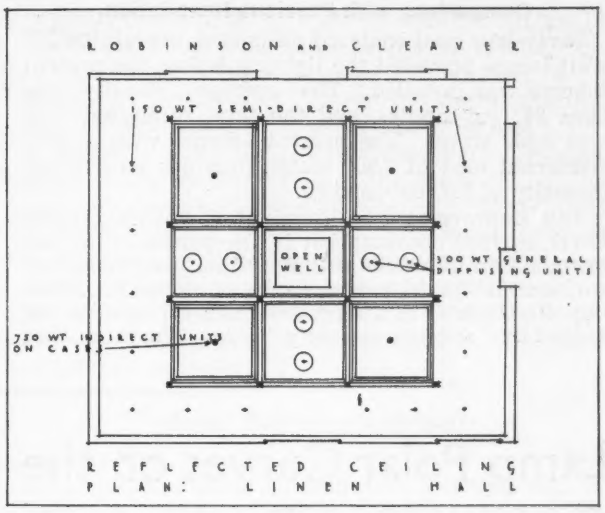

ROBINSON AND CLEAVER
150 WT SEMI-DIRECT UNITS
OPEN WELL
300 WT GENERAL DIFFUSING UNITS
750 WT INDIRECT UNITS ON CASES
REFLECTED CEILING PLAN: LINEN HALL

Fig. 4.

In the general lighting of the stores the main considerations were the following:—

(1) A definite relationship of the lighting to the plan.
(2) The provision of adequate illumination where most required.
(3) The provision, so far as possible, of an air of cheerfulness.
(4) Economy in current consumption.
(5) Easy maintenance, consistent with the above conditions.

The Linen Hall.

The plan of the linen hall (see Figs. 3 and 4) is most easily described as a room approximately ninety feet by eighty feet, containing sixteen columns resulting in the formation of nine squares, with a narrow border surrounding them. Cases and counters are arranged diagonally across the outer squares, leaving a large space in the centre for eight low show cases, thus giving an effect of spaciousness to the central area. Round the walls are additional cases and counters forming a frame to the central area.

An analysis of the plan makes one point quite clear: that adequate light must be provided on the diagonally-placed counters and cases and those arranged round the walls. The arrangement of the lighting units aims at providing this result. Three systems of lighting are incorporated:

1. General diffused. 2. Indirect. 3. Direct.

The general diffused lighting takes the form of eight 20 in. opal spheres fixed in the centre of small domes. Each contains a 300 watt lamp, and is capable of accepting 500 watts. Two of these fittings are placed in alternate squares forming a cross in the ceiling plan. This illuminates the walking area, but diminishes in strength over the diagonal counters and cases. The large surface area of the sphere results in a low surface brightness and prevents the appearance of a "light spot."

To supplement the above, indirect lighting is provided from a cylindrical container housing a reflector and a 750 watt lamp, and capable of accepting 1,000 watts. This is controlled to illuminate the four remaining squares, confining the light as much as possible within them. The result is that soft, diffused lighting is provided, and owing to the fact that this portion of the ceiling is very highly illuminated, a sense of brightness prevails.

Forming a border around the nine squares just described, there are twenty 150 watt direct diffused fittings which supply the light for the counters against the walls. All the show cases are lit by reflectors containing tubular lamps, which help considerably towards creating a cheerful atmosphere. The perfumery section is illuminated by means of three indirect dish type fittings; glare is thus avoided and an impression of a uniform and soft light is given.

Fig. 5. A View of the Perfumery Dept., showing effective overhead lighting.

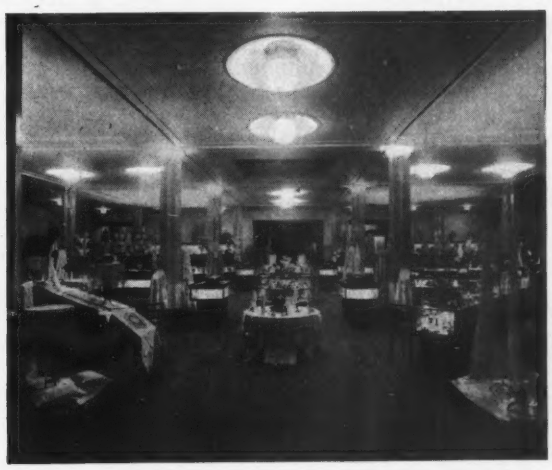


Fig. 6. A typical portion of the lighting by means of 300 watt lamps in opal spheres fixed in the centre of small domes.

Comparison with Previous Installation.

Forty-four opal enclosed units each containing 200 watt lamps provided the lighting before the present scheme was installed. The average intensity was then 3½ foot-candles, and the total connected load was 8,800 watts. The present scheme with a total connected load of 8,400 watts, provides an average intensity of 8.5 foot-candles.

This improvement of illumination with a slightly lower current consumption is due primarily to the introduction of a false ceiling with a good reflecting surface. It should, moreover, be borne in mind that the effectiveness of a scheme of this type cannot be judged by "average intensity" only. The intensities are necessarily variable, but the point is that adequate illumination is deliberately concentrated in places where it is mainly needed.

The present scheme consists of thirty-two separate units, as compared with forty-four originally.

The provision of totally enclosed units was found desirable with a view to ease of maintenance. The four indirect units over the cases are, however, open, but cleaning is here facilitated by very easy access to the fittings.

The lighting installation was planned by the writer in collaboration with Mr. R. E. Enthoven, A.R.I.B.A., of Messrs. Pakington and Enthoven, in whose hands the whole of the redecoration had rested.

Lamp Polar Curves on the Cathode Ray Oscillograph

The ingenious apparatus described below will be on view at the Physical Society's Exhibition which opens on January 7 at the Imperial College of Science and Technology. The apparatus enables the polar curve of a lamp of moderate dimensions to be formed practically instantaneously, and the effect of placing a reflector over the lamp is immediately evident by the change in the curve which occurs before the eyes of the observer. We are indebted to the courtesy of the authors and the "Journal of Scientific Instruments" for permission to summarise the original article describing this interesting device.

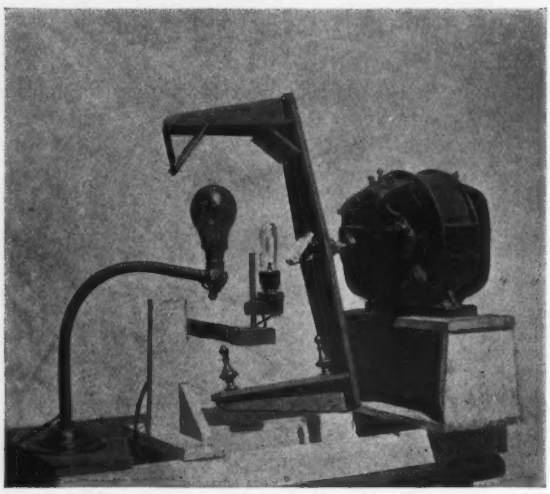


Fig. I. A General View of the Apparatus for obtaining Polar Curves of Light Distribution, showing the Rotating Mirrors.

An article in the "Journal of Scientific Instruments," pp. 253-255, Vol. XII., No. 8, August, 1935, by V. J. Tyler and R. Hanbury Brown, of the Technical College, Brighton, describes an apparatus for recording visually and photographically the polar curves of lamps, thus enabling the effect of variation of filament form and method of control by fittings to be immediately seen.

The lamp L is stationary and the candle-power in any direction is recorded by reflecting the light by means of three mirrors on to a fixed photo-electric cell P, surrounded by a screen S with a circular aperture, thus, in effect, removing the cell to a considerable distance from the lamp and enabling it to receive a light beam confined within a small solid angle. The framework A, holding the mirrors, revolves about a horizontal axis through the lamp by means of a shaft, which also rotates two cranks C_1 and C_2 in quadrature.

The varying current from the photo-electric cell, when receiving light from different directions round the lamp, passes through a high resistance R_2, the potential across which is applied to the grid of a single-stage amplifier. A potentiometer R, in the anode circuit, has one end connected to a point of the anode battery, whilst the potential of the other end is varied, due to the varying current from the photo-electric cell. An intermediate point of this potentiometer is connected to two of the plates of a cathode ray oscillograph, whilst the other two, controlling the deflection in two directions at right angles, are connected by means of the cranks C_1 and C_2 to variable contacts X and Y on the potentiometer. Hence, for a given position of the mirrors the potential differences applied to the two sets of controlling plates may be represented by V sin wt. and V cos wt. where V is proportional to the candle-power of the lamp corresponding to the setting of the mirrors. The corresponding deflections of the oscillograph spot will be A sin wt. and A cos wt., the resultant deflection being $A^2 \sin^2 wt. + A^2 \cos^2 wt. = A$.

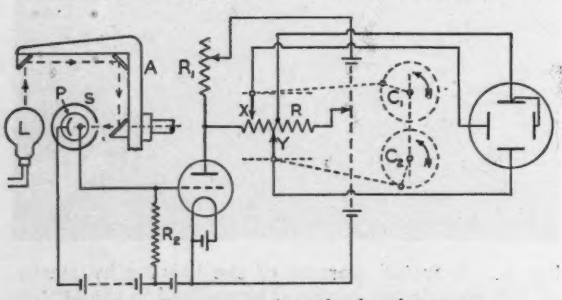


Fig. 2. Circuit used with the Apparatus.

If the mirrors remain fixed whilst the cranks rotate the spot will rotate in a circle with the same angular velocity as the cranks. If, however, the mirrors also move, the deflection for each position of the mirrors will be proportional to the candle-power in the corresponding direction and the spot will now rotate with the same angular velocity as the mirrors. Hence, the polar curve will be traced out. If the speed of rotation is sufficiently high the tracing will appear as a continuous curve.

In the "no light" condition, the steady anode current is balanced out from R by a variable resistance R_1 in conjunction with a voltage tapping on the anode battery.

How Better Lighting Aids the Eye

Notes on the paper entitled "Visual Perceptions under Modern Conditions," read by Dr. R. J. Lythgoe at the meeting of the Illuminating Engineering Society on November 12, 1935, and the ensuing Discussion.

The paper read by Dr. R. J. Lythgoe at the recent meeting of the Illuminating Engineering Society brought together quite an assembly of physiological experts—headed by Sir John Parsons, a past president, who was responsible for the very first paper ever read before the Society. In 1909 he spoke on "Glare, Its Cause and Effects," a question with which the lighting industry is still struggling! Sir John complimented the Society on its wisdom in seeking the aid of the physiologist. He added, however, that this had been forced upon lighting experts by the fact that certain problems—street lighting and the lighting of aerodromes, for instance—can only be solved through an understanding of the eye and the factors involved in "visual capacity." (Visual capacity or "seeing power" is broader than "visual acuity," which is usually regarded as expressing simply the perception of form or outline.)

Higher Illumination and Seeing Power.

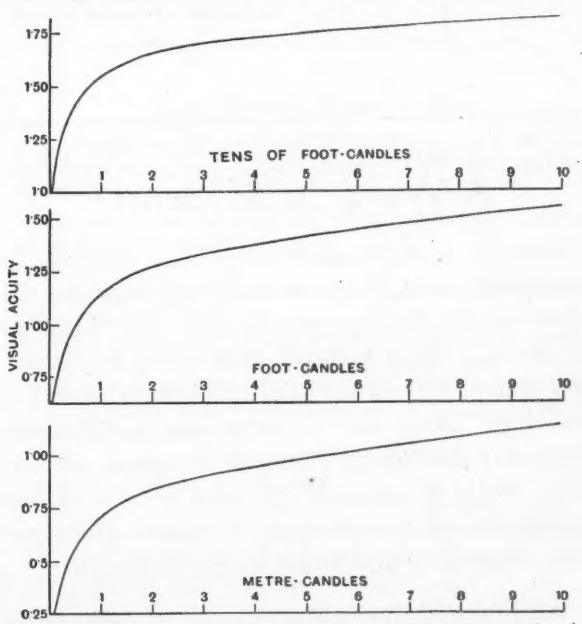
Dr. Lythgoe discussed in some detail the effect of increasing brightness on visual acuity. In the case of simple tasks increases in power of perception after 10 foot-candles are comparatively small; yet, as Cobb has shown, there may be continuous improvement in visual performance, certainly up to 130 foot-candles. In the concluding part of his paper Dr. Lythgoe remarks that as illumination is increased from 5 to 1,000 foot-candles, there is a steady increase in all visual tasks—with the exception of the perception of differences of brightness. This is recognised in common practice. Where, before the war, four foot-candles was the recommended minimum, to-day 10 foot-candles are usual. There are, Dr. Lythgoe remarks, a few people left who say that 10 foot-candles indoors is too high; but who take their holidays fishing in 10,000 foot-candles! He also illustrated by lantern slides—what to many of us would seem a rather peculiar choice—the traditional habit of lacemakers in Geneva to ply their trade in full sunlight in the open, when there must, presumably, be at least 10,000 foot-candles on the job!

Too Much of a Good Thing.

But, curiously enough, the effect of brightness on the power of the eye to recognise small changes in brightness is different from its effect on visual acuity (perception of form). Here excessive brightness may prove too much of a good thing. This was illustrated by the case of a concrete wall which in bright sunlight appeared smooth and uniformly bright, whilst in the evening it appeared to be covered with areas of light and shade. Therefore, whilst for the majority of everyday tasks the higher the illumination the better, there are some specialised tasks, involving the perception of light and shade (e.g., the recognition of areas of stain on lengths of cloth), for which a moderate brightness is best. Dr. Lythgoe suggests in such cases a brightness of "3 equivalent foot-candles"*, at which the recognition of small differences in brightness is at its best. This is surely a most important conclusion. Another point, raised by Dr. Walsh in the discussion, which certainly needs consideration is how far the value of a certain contrast depends on the general order of brightness, and therefore on the illumination provided. For the purpose of "the man in the street," a 20 per cent. contrast at 1 foot-candles may be something very different from the same degree of contrast at 1,000 foot-candles!

Avoid Extreme Contrasts!

A striking quality of the eye is its marvellous power of adaptation to enormous changes such as from 1 to 10,0000 foot-candles. It does, however, dislike extremes of contrast. Therefore—as one of the speakers in the discussion, Mr. T. C. Angus, illustrated by means of study lamps—one should avoid like the plague intense brightness on the work and surrounding obscurity. Be it noted that the effect works both ways. A brilliant source in the field of view causes discomfort. But a large expanse of black in the field of vision may affect one in the same way as a glaring light source though the ill-effects may not be measurable by any known test. There should never be great differences in brightness between the task and the surrounding field of vision. Also we should never allow the surrounds to become brighter than the work itself. When the work consists of dark woven materials the walls should be made darker than the work, not, of course, by painting the walls black, but by providing strong local lighting so as to bring the brightness of the dark cloth up to the desirable value. The pleasant effect



This diagram shows how visual acuity improves with increasing illumination; also the importance of the scale in showing that improvement, though most evident at low illumination values, does not soon cease, but continues even when quite high values are reached.

* This means a little more than 3 foot-candles illumination on clean white cloth, but about 60 foot-candles on very dark material reflecting only 1/20th of the light falling upon it.

of daylight is partially due to the fact that there are usually no great extremes in brightness. The range of contrasts usually does not exceed 40 : 1.

Make "The Work" the Brightest Thing.

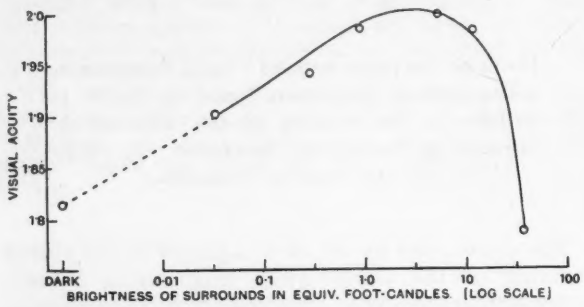
The serious effect of injudicious contrast in impairing the performance of the eye was emphasised by Dr. Lythgoe. By means of a diagram he showed what happens when, with a constant illumination of 13 foot-candles on the object, the brightness of the surrounding area exceeds that of the object viewed—with the natural result that the latter appears correspondingly dark. If the surrounding area is in complete darkness the efficiency of the eye steadily improves as the surround becomes brighter until this surrounding area becomes of approximately the same brightness as the object seen.

But immediately the surroundings become *brighter* than the thing looked at the performance of the eye is impaired, and gets worse and worse as the reverse contrast is increased.

It is a sound rule that **the material with which one is working, or the page which one is reading should be the brightest thing in sight—but not much the brightest.**

Effects of Coloured Light.

In the latter part of his paper Dr. Lythgoe speculated on the effect of colour on the eye. He recalled the inability of the eye to focus blue light and red light simultaneously. Hence, a distant point-source observed through cobalt glass appears as a red central area with a surrounding blue halo or vice versa. He also made the suggestion that the difference in wavelength of the yellow line and the blue line in electric discharge lamps might make it difficult for the eye to focus both simultaneously, and might thus give rise to headaches! This view, however, was strongly contested by several speakers during the discussion. Mr. C. C. Paterson and Mr. G. H. Wilson both stated that this fear was not justified by practical experience. The former also showed, by means of diagrams, that the amount of blue radiation in the spectrum of the electric discharge lamp is relatively minute, and that the light is located almost entirely in the green and yellow lines which are quite close together and therefore easy to focus simultaneously.



This diagram is instructive in showing the vital importance of the brightness of the area surrounding the object looked at. Starting with a background of complete obscurity visual acuity improves progressively as the brightness of the background increases *until* the brightness of the object (13 equivalent foot-candles) is reached. From that point onwards — as the brightness of the surround becomes greater than that of the object—visual acuity rapidly falls.

Daylight and Artificial Light.

In the concluding part of his paper Dr. Lythgoe had some interesting things to say about daylight and artificial light. He did not believe that the difference between daylight and ordinary uncorrected artificial light (e.g., the light from a gasfilled filament lamp) was nearly enough to give rise to any difference in visual acuity. He remarked on the common experience that uniform installations are apt to appear dull. Not only does the lighting appear featureless but also too low in intensity. There was some reason to suggest that in judging brightness the eye takes its cue from the brightest object in view.

A Word to Students

Students at Technical Colleges are reminded of the special arrangement whereby they may join the Illuminating Engineering Society as "Affiliated Students." For a nominal subscription of 10s. 6d. per annum they receive the privilege of attending meetings, taking part in visits, and receiving the journal of the Society. The only conditions are that they should be between the ages of sixteen and twenty-five and should obtain the signature of someone in authority to a simple form of application.

All Affiliated Students are eligible to compete for the Silver Jubilee Commemoration Award (1934), which is awarded annually for (a) the presentation of a paper dealing with the theory or practice of illuminating engineering, (b) the design or construction of a novel instrument for research therein, or (c) a record of research or investigation beneficial to illuminating engineering.

Visual Efforts and Heart Beats

A novel method of exploring the effect of increased illumination is described by M. Luckiesh and F. K. Moss in the "Journal of General Psychology" (1935, 13, 131-139). When a subject is asked to read steadily there is progressive depression of the heart rate during the period of the visual task. The diminution, however, was found to be much greater under 1 foot-candle than when 100 foot-candles were provided.

I.E.S. DINNER AND DANCE
February 4th, 1936

Why Not Make Up a Party?

1931 - 190
1932 - 200
1933 - 210
1934 - 220
1935- 260

Make it 300 Next Time!

Public Lighting

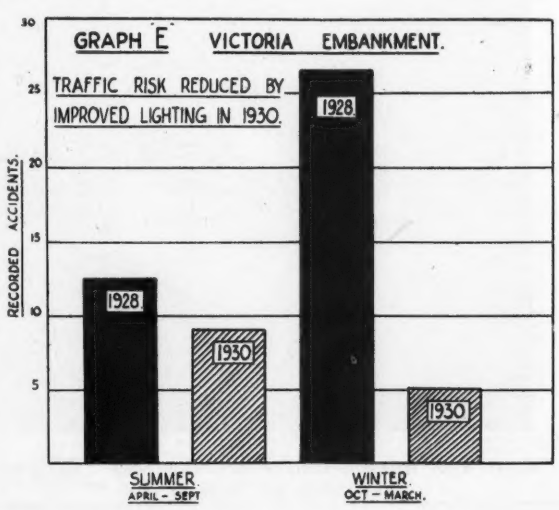
Its Necessity and Administration

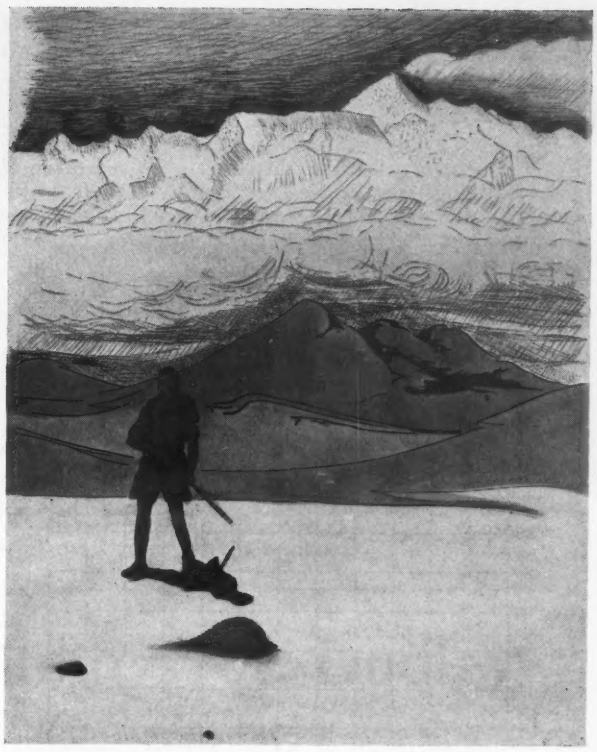
In a paper read at the Public Works, Roads and Transport Congress on Nov. 19, 1935, Mr. E. C. Lennox (Vice President of the Association of Public Lighting Engineers) traced the relation between Road Accidents and Public Lighting, illustrated the inequality of the present Administration of Public Lighting (which results in Rural Parishes having to bear more than their fair share of the cost), and made a series of practical suggestions for the future.

Although in part anticipated in the Interim Report of the Ministry of Transport Street Lighting Committee, summarised in our last issue, the suggestions made in Mr. Lennox's recent paper at the Public Works, Roads, and Transport Congress were opportune and helpful. The initial part of the paper dealt in some detail with the relation between accidents and public lighting—a very intricate and difficult problem—and the latter portion with administrative problems. The data in this latter section, showing the extraordinary variations in conditions in the areas of the different urban and parish councils through which an arterial road frequently passes, were most instructive.

Road Accidents and Public Lighting.

It is well worth while to examine what happens during "dark hours," which form about 46 per cent. of the total annual period. To show that improved public lighting definitely reduces the risk of accident is not easy—even though most of us believe that this must be so. When the lighting of a road is improved drivers can see better—hence the volume of traffic increases (it has been found actually possible to divert the stream of traffic in this way!). Drivers also find that they can make better speed, and proceed to do so! On the other hand, a road may be so badly lighted as to be shunned and little used, with the result that accidents are few. We can only get a true picture when the accident data, the lighting conditions, and the volume and speed of traffic are correlated. This is rarely possible.





A Striking Picture shown by Mr. C. C. Paterson in his Presidential Address to the Junior Institution of Engineers.

Mt. Everest, in the background, represents the order of illumination in bright sunshine (8,000 ft.-c.).

Moderate hills, of about the height of Snowdon, represent to the same scale comfortable daylight (700 ft.-c.).

The height of the man is equivalent to the illumination at dusk, just before street lighting is switched on (3 ft.-c.).

The molehill in the foreground stands for "reasonable" illumination for streets (0.2 ft.-c.).

The mole that makes the molehill (seen in the left hand lower corner of the diagram) is equivalent to moonlight (0.02 ft.-c.).

But in many of our badly lighted streets the illumination is even lower than this. It could only be pictorially represented by the dignified height of a worm-cast!

Some Definite Conclusions.

Nevertheless, by analysing the informative records produced by the National Safety First Association, there are certain conclusions we can draw.

Amongst the conclusions drawn by Mr. Lennox were the following:—

In the full year over one-third of accidents occur during dark hours.

The proportion of accidents in dark hours varies from 12 per cent. in summer to 67 per cent. in winter. Similarly, the "accident rate" during dark hours varies from 0.31 per hour in mid-summer to 0.95 in mid-winter.

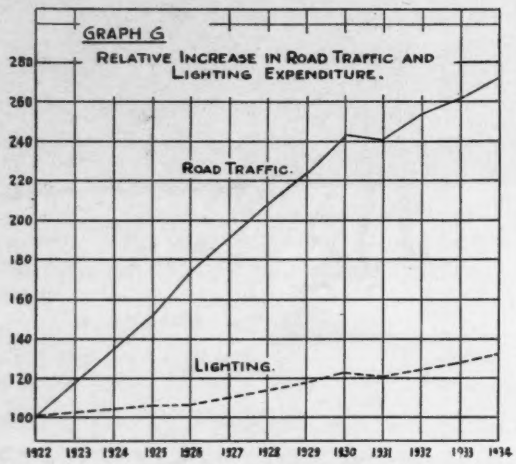
In winter months the accident rate at night is double that in the daytime.

The high accident risk during dark hours in non-built up areas does not seem to justify the assertion of some motorists that headlights are better than an efficient lighting system.

Attention is drawn to the striking data relating to the Victoria Embankment, London (summarised in the adjacent table). Mr. Lennox also quotes from the analysis made in the U.S.A. by Mr. R. E. Simpson, who found that the accident (night-day) ratio varies from 3.5 in well-lighted roads to 20 per cent. in poorly lighted roads. Surely, he suggests, it is not too much to suppose that given efficient lighting of streets and roadways the accident rate at night would decrease at least to that during daylight hours.

Difficulties in Administration.

The latter part of the paper was devoted mainly to problems of administration. The various authorities with powers to undertake lighting are administrative counties, cities, municipal boroughs, urban and rural districts, and rural parishes. Rural parishes through which arterial roads may pass are often in a most difficult position. Even if they can afford the cost of public lighting, their powers are limited. They can only negotiate for a loan, after securing in turn the consent of a parish meeting, of the county council, and of the Ministry of Health.



A Graph shown by the author to illustrate the vast growth of traffic during 1922-1934, rendering better public lighting necessary.

In London alone there are about thirty-five lighting authorities, and throughout the country about 8,000 —all with their own ideas and practice in regard to public lighting. The difficulty in securing uniformity is evident!

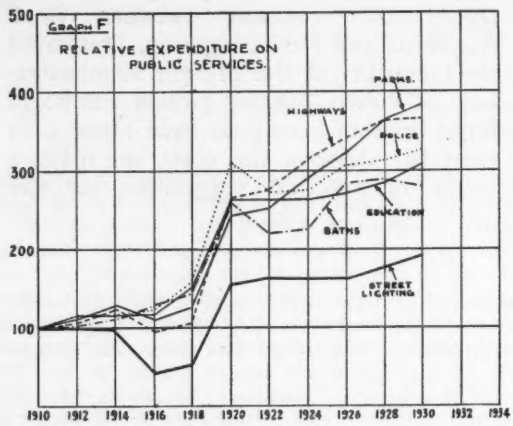
An instructive example of variation in the amount of lighting on different sections of a road, the types of lighting authorities affected, and the rateable value is afforded by the Great North Road, County Durham. Since good-class lighting has been installed on two sections no serious accident has occurred. But on other parts of the road, where there are dangerous crossroads and where there have been bad accidents, the lighting varies from "fair" to "poor"—and some are still unlighted! The rate requisite to furnish adequate lighting varies from 4d. to 1s. 10d. in different areas, but in one case a rate of 10s. for this purpose alone would be needed!

Conclusions.

The following are a few of the conclusions set out at the end of Mr. Lennox's paper:—

The proportion of accidents by night is unduly high and has increased progressively during recent years, owing to the increase in the use of roads during dark hours.

This increase is due to lack of visibility, as a result of which the pedestrian suffers more than the driver.



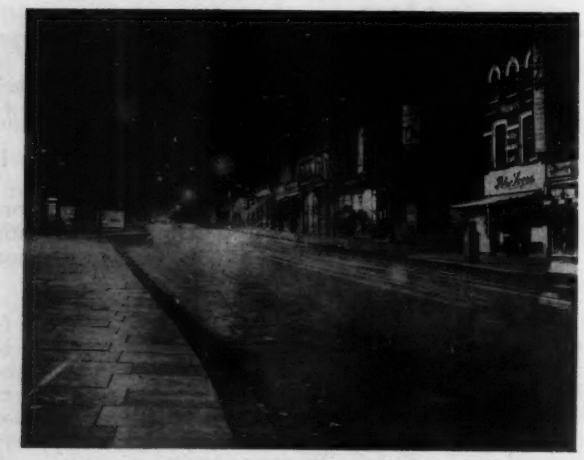
A record of public expenditure; street lighting still falls behind highways and parks, police, education and baths.

The cost of efficient public lighting would probably be less than the saving it would effect in reduction of accidents and crime.

Public lighting is of general benefit. Its cost should not be borne parochially. No hope of efficient schemes of uniform lighting can be entertained unless public lighting is handled by a central authority.

No smaller unit than a county borough should be a lighting authority. Street lighting installations should be under the control of a competent public lighting engineer, with a central authority (e.g., the Ministry of Transport), to classify roads for lighting purposes, and to set up standards for various classes, bearing in mind traffic density, with a view to obtaining uniformity.

Public lighting is necessary during 46 per cent. of the year, and is more vital to-day than ever before.



A section of roadway in Lewisham where Osira electric discharge lamps in refractor lanterns have recently been installed.

A view of Brixton Hill, where the new "Supervia" gas lamps are now in use.

Brightening Cirencester.

An appropriate step towards brightening the Market Place in this Jubilee Year has recently been taken in Cirencester. A new lighting system has recently been installed; eight new gas lamps, supported on four central standards, have replaced seven of the older pattern, which were mounted on the pavement. The adjacent picture suggests that there is now certainly plenty of light.

A Night View of the Market Place, Cirencester.

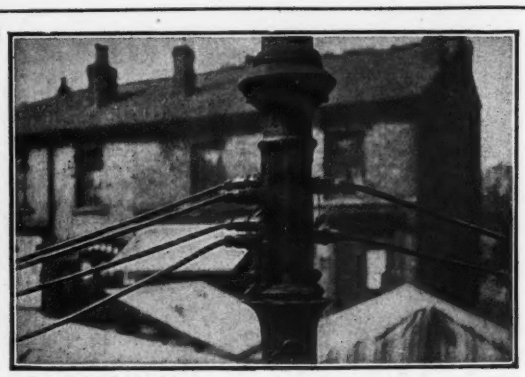
New Municipal Buildings at Dudley

Effectively illuminated by Revo Lanterns

A View of the Decorative Fitting employed.

The adjacent pictures show a night-view of the new Dudley Municipal Buildings, which were recently opened by H.R.H. the Duke of Kent, and also illustrate the appearance of the Revo lantern responsible for the excellent street lighting effect. The view on the right, for which we are indebted to Revo Electric Co., Ltd., furnishes a good example of public lighting which creates uniform brightness on the road surface, but reveals the surroundings also.

Street Lighting which both illuminates the roadway and reveals the adjacent Municipal Buildings.



This illustration of part of a "NIPHAN" market lighting installation shows main feeding sockets fitted to a lamp standard. The "NIPHAN" system is adaptable for every type of temporary or portable lighting installation. and designs will gladly be submitted.

MARKET LIGHTING with the NIPHAN System . . .

FOR some years we have been collaborating with public lighting authorities in devising temporary lighting installations for market stalls. The picture shows part of a "NIPHAN" market job, in which 6 sockets, in conjunction with a fuse board, were mounted on a lamp standard, with plugs leading to 3-way tees and suspended through-sockets.

¶ *Our extensive market lighting experience is at your disposal.*

Announcement of
SIMMONDS & STOKES LTD.,
4, Vernon Place, Southampton Row, London, W.C.1.

NIPHAN

Tel.: Holborn 8637. 'Grams: "Niphon, London."

MODERN DOMESTIC LIGHTING

"Raumo": Mr. W. Ford Hall's Wonderful House at Snaresbrook.

In this "all electric" house the total load is at present 71 kW — which will be increased to 100 kW when the proposed floodlighting of the tennis court and colour flooding of the garden are completed. 13 kW has been expended in the interior lighting, for which tubular lamps are largely used, and which is mainly "architectural" in type. The architect responsible for the structural work was Mr. C. E. Owen Ward. The electrical contractor was Mr. L. J. Beard, of Leyton.

THE writer was recently afforded by Mr. L. J. Beard an opportunity of seeing over "Raumo," Mr. W. Ford Hall's home at Snaresbrook, the lighting of which has been planned on entirely modern lines. The switching and wiring, too, have interesting features, the control in some instances being exceptionally complete.

Architecturally the interior of planning of the house is remarkable for the economy in space. On the ground floor rooms are closely adjacent and ingeniously connected. The only corridor is that on the upper floor, running between the bathrooms and bedrooms (five in number). For a house of moderate size the total electric load—expected to attain 100 kW. when the flood-lighting of the tennis court and the garden colour-lighting are provided—is, we believe, unique. The present total of 71 kW. is distributed as follows: lighting, 13; cooking, 10; water heating, 10; external (garden, etc.), 7.

On approaching the porch one observes the name "Raumo" in the form of a Siemens neonic lamp sign in waterproof case. The porch itself is lighted by an amber-tinted glass panel containing one 24 in. x 30 m.m. architectural tubular lamp.

Fig. 1. A Glimpse of the Lounge Hall with diffusing panel fittings and laylights overhead.

The Lounge Hall.

Similar lamps again figure in the lounge hall (Fig. 1), two being used for each of the three ceiling laylights. The arrangement of these lamps was aided by skilfully applied curved reflecting surfaces, and the brightness of the laylights was very uniform, considering the very small space available above the ceiling. Similar methods are used in the niche grills in the walls, clear orange and flame-sprayed strip lamps being here applied to produce a glow ranging from white at the bottom to flame at the top of the recess. This soft and restful method of lighting is well suited to the somewhat low height of the lounge hall and to the style of decoration and the wood-panelled walls. This room has the distinction of being

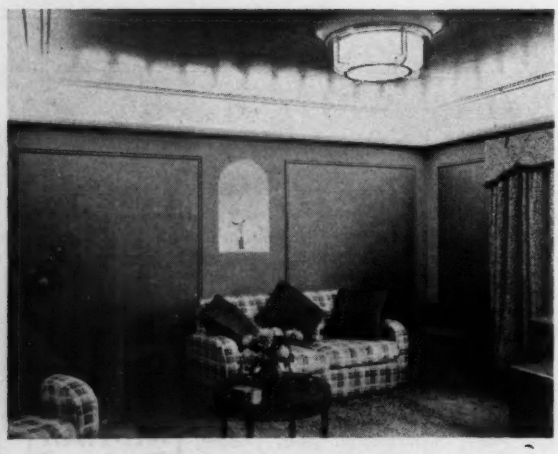


Fig. 2. The Lounge. Cornice Lighting is combined with the central fitting. Colour Lighting is furnished for the niche seen in the background.

Fig. 3. A Bedroom (No. 1). Note the very unusual method of bed lighting, the electric clock with luminous side panels, and the electric fire with a luminous surround.

the only one in which a coal fire is used—during the three winter months only. Thereafter the coals are removed and a 3 kW. electric imitation coal fire takes its place. In this connection an ingenious expedient is adopted. Through the side of the fire-place an inconspicuous channel several feet long gives access to the power plug. When the electric element replaces the coals, all that is needed is to pass the lead through this channel and plug in.

In passing, a word may be said in regard to the switching on of this and such other electric fires as utilise heating elements in the foreground and an imitation glowing coal fire behind. The latter, of course, is for effect only and gives off practically no heat. The switch is actually a black object amidst the "coals," into which the hand is plunged when the electricity is to be switched off—a piece of realism which is perhaps in keeping with the present age!

The dining room is again lighted by a laylight flush with the ceiling and aided by four corner brackets of somewhat unusual design which serve to modify shadows and relieve the monotony. In the adjoining loggia a departure in method is made, four "emblique" brackets of pleasing cylindrical design being here adopted.

The Lounge.

The lounge proper (Fig. 2) is perhaps one of the most interesting rooms in the house. In some respects the procedure in the dining room is reversed. Cornice trough lighting with sixty-four tubular lamps, consuming 1,920 watts, forms the main source of illumination.

Owing to the low story height the centre fitting is this time the additional element introduced in order to break up shadows. This fitting has a matt silver frame and pink flashed opal glass luminaire. Strip lamps are again used for the concealed lighting of the alcove (not visible in the picture) whilst seven 25-watt lamps (two red, two green, and three yellow) placed under an obscured armour plate glass shelf permit six definite colour changes in the lighting of the niche, visible in the background of Fig 2. The

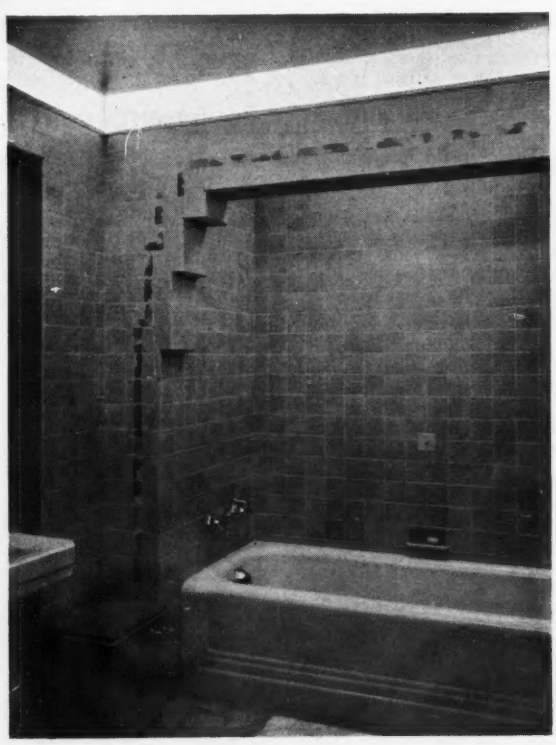


Fig. 5. A Bathroom showing built-in luminous strip for general lighting: supplementary lighting is also provided above the bath in the recess.

Fig. 4. Another Bedroom: central diffusing unit and subsidiary local lighting.

diffused lighting furnishes a luminous background against which the poised female figure is seen in silhouette. In the decorative scheme of this room, in which rose and green are the dominant colours, the lighting and decoration are skilfully blended.

Nothing special needs to be said in regard to the lighting of the kitchen, larder, scullery, and maids' sitting room, which is effected mainly by opal cube fittings mounted direct on the ceiling. The illumination, however, is excellent both as regards intensity and freedom from glare. It was very satisfactory to find that in this model home the lighting of the servants' premises had also been planned on a generous scale.

Bedroom Lighting

The standard of originality in lighting is fully maintained on the first floor, where the bedrooms and bathrooms are situated. We reproduce in Figs. 3 and 4 typical views of bedrooms. Bedroom No. 1 (Fig. 3) is the most elaborate. The central fitting utilises pink sandblasted glass in a matt silver frame, illuminated by three 12-inch and four 20-inch architectural lamps. The basin and tallboy are both fitted with flush panels. At the dressing table there is at present a standard of conventional design, but this is to be replaced by a more perfect system of lighting through the two side mirrors—an arrangement which seems to obyiate the drawback of "reversed contrast" which is apt to arise when lighting is incorporated in mirrors facing the observer. Even the electric clock above the fireplace is furnished with luminous side panels. The electric fire is equipped with a luminous surround, the colour of which, either warm or cool in effect, can be modified according to the season of the year.

The most striking feature of the lighting of this room is, however, the unusual method of bed lighting. This is effected by means of a trough behind the bed-head, throwing light on to a coved plaster cast, which in turn reflects a soft light over the beds. The trough is fitted with four 20-in. by 40-mm. and four 24-in. by 30-mm. architectural lamps and is glazed with obscured armour plate glass. Control of either the whole or half of this lighting can be exercised either from the bedside or the door.

The other bedroom illustrated also makes a charming picture. Attention may be drawn to the central mushroom-like diffusing fitting, the special light above the dressing table and the diffusing panels which light the couch in the window recess.

The design of the bathroom illustrated in Fig. 5 is entirely modern. The bath here shown is built into a recess with special lighting from above by means of architectural lamps mounted above sandblasted diffusing glass. Shower recesses are treated in the same manner.

Literature on Lighting

(Abstracts of Recent Articles on Illumination and Photometry in the Technical Press)

I.—RADIATION AND GENERAL PHYSICS.

1. The Colour Temperatures of the Hefner and Acetylene Flames.

A. R. Pearson and B. Pleasance. Proc. Phys. Soc., 1,032, November, 1935.

The colour temperature of the Hefner flame was found to be 1910K. The colour temperature of an acetylene flame depended on three factors: Gas pressure, consumption rate, and height of flame. If suitable values of these three factors are maintained, the colour temperature of the middle portions of the flames given by different burners do not vary by more than ± 20°K, typical figures being 2380K and 2400K. S. E.

2. The Limit of Visibility of Light Sources.

W. Arndt. "Das Licht," 220, October, 1935.

Curves are given showing the relation between the angular size of light sources (in seconds of arc) and the brightness at which they are only just visible to a dark adapted eye. A curve is also given showing how the intensities in Hefner lux that are only just visible depends on the brightness of the background. In the dark, a light source of 0.002×10^{-6} lux is easily visible. S. E.

II.—PHOTOMETRY.

3. A Subjective Photometer.

W. D. Wright. J. Sci. Inst., 373, December, 1935.

This photometer has been designed to measure the variation of sensitivity of the eye for different conditions of the visual mechanism. The principle employed is that of binocular matching, in which the intensity of a field viewed by the left eye is compared with that of a similar field viewed by the right eye, the variation in intensity being controlled by a calibrated photometer wedge. S. E.

4. A Trichromatic Colorimeter.

R. Donaldson. Proc. Phys. Soc., 1,068, November, 1935.

A trichromatic colorimeter is described in which the integrating properties of a diffusing sphere are employed to effect the mixture of the three primary colours used to build up a match with the colour under test. For these three primaries, glass filters are used for the red and blue, while a Wratten filter is used for the green. The quantities of these primary colours admitted to the integrating sphere are controlled by shutters working in rectangular slots. The light passing through the three shutters is collected by a lens and focussed on an opening in the wall of the integrating sphere. Matching is then carried out in the usual way by means of a bipartite photometric prism. S. E.

5. The Colour Matching of Tungsten Filament Lamps by Means of a Single Photocell and Colour Filters.

J. S. Preston. Proc. Phys. Soc., 1,012, November, 1935.

A method of colour matching tungsten light sources is described, in which one photocell and two coloured filters are employed. The ratio of the transmissions of two filters as measured by the photocell gives an empirical measure of the colour temperature of the source. To determine the voltage at which a lamp has the same colour temperature as a similar standard lamp, the green/red ratio of the standard lamp is determined. The standard is then replaced by the lamp on test, and its green/red ratio determined for two or more voltages. Interpolation then gives the voltage at which the test lamp matches the standard. S. E.

6. Applications of a Photoelectric Cell.

A. H. Lamb. Elect. Engineering, 54, pp. 1,186-1,190, November, 1935.

A detailed description is given of a photoelectric cell of the dry disc type, not requiring a vacuum or liquid for operation. Characteristics of the cell are described, and a number of typical applications given. S. S. B.

III.—SOURCES OF LIGHT.

7. Low Voltage Neon Tubes.

David Krestin. El. Rev., Vol. CXVII., No. 3,026, p. 706, November 22, 1935.

Reviews progress in neon-tube lighting and describes the use of the negative-glow discharge for low-voltage tubes. R. G. H.

8. Provides Sunlight without Sunburn.

Anon. El. World, 105, p. 2,696. November 9, 1935.

A brief description is given of a lamp combining a small mercury vapour lamp, emitting ultra violet light but very little visible light, with a tungsten filament, enclosed in a corex-glass outer bulb. It is stated that no transformers are required, as the filament acts as ballast for the arc. S. S. B.

IV.—LIGHTING EQUIPMENT.

9. The Public Works, Road, and Transport Exhibition.

Anon. El. Rev., Vol. CXVII., No. 3,026, p. 705, November 22, 1935.

Describes exhibits of interest, including a remote control system of public lighting, a vehicle-actuated system of traffic signals, and a system of interior illumination by neon tubes of colours blended to give a good colour-rendering. R. G. H.

REPRINTS OF "LITERATURE ON LIGHTING"

At the request of certain of our readers we are arranging to issue reprints of "Literature on Lighting," printed on one side of the paper only so as to be in a convenient form for cutting up and filing or pasting into records.

Reprints will be sent monthly to all readers who so desire at a nominal charge of 5s. per annum; and will be furnished free, on request, to all contributors to "Literature on Lighting."

10. Cinema Studio Unit.

Anon. Elect., 115, pp. 681 and 683. November 29, 1935.

Cinema studio units, each consisting of an assembly of reflectors, and burning high wattage general service lamps are described. A photograph is given. C. A. M.

11. Melbourne Electrical Exhibition.

Anon. Elect., 115, p. 707, December 6, 1935.

A group of photographs is given of interior house lighting demonstrated at the Melbourne Electrical Exhibition. C. A. M.

V.—APPLICATIONS OF LIGHT.

12. Light Study Course for School Use.

Anon. El. World, 105, p. 2,702, November 9, 1935.

A scheme has been prepared in U.S.A. for instruction in the schools on light and seeing. The course consists of eight lessons on each of these two parts, and two illustrative charts are provided. The programme is the first step in a broad educational plan for the conservation of eyesight among school-children. S. S. B.

13. Trial Lamps to Further Better Light—Better Sight.

Anon. El. World, 105, p. 2,679, November 9, 1935.

A note of a scheme to introduce better lighting in the home by supplying free a temporary unit, constructed out of paper and cardboard. It is thought that the user, having experienced the benefits of good lighting, will maintain a higher standard subsequently with properly designed units. S. S. B.

14. Lighting Bureau.

Anon. Elect. 115, p. 722, December 6, 1935.

The showrooms of the Lighting Service Bureau in Glasgow have recently been re-equipped with modern lighting equipment. Photographs are given. C. A. M.

15. Salon de la Lumière.

Anon. Elect., 115, pp. 599-600. November 15, 1935.

Descriptions, with photographs, are given of numerous demonstrations made at a recent exhibition in Paris. C. A. M.

16. Gateways of Light.

Anon. El. Times, 88, p. 667, November 28, 1935.

A description, with photographs, of various illuminated gateways used at the Exposition de Bruxelles, 1935. W. R. S.

17. Lighting of the National Road No. 7 Between Levers and Pougues-les-Eaux [Nièvre].

Anon. R.G.E., XXXVIII., No. 19, p. 618, November 9, 1935.

An account of this lighting, with photographs. Both sodium discharge and tungsten filament lamps are discussed. W. R. S.

18. Street Lighting with Gas.

Gas World, November 30, 1935.

Contains some interesting references to the new high-pressure gas street-lighting installations in Corporation-street and New-street, Birmingham. Some references to the relation of street lighting to accidents are given.

19. Selling the Lighting Load.

Gas Industry, December, 1935.

Contains an article entitled "Selling the Lighting Load," more particularly from the point of view of gas lighting.

20. Theatre Lighting Control.

D. M. Rollins and B. S. Burke. Electric Journal, Vol. 32, No. 11, p. 477, November, 1935.

Complete control of all the lighting in a large New York theatre is possible from one switchboard. Operation can be by rehearsal control, so that great flexibility of operation is possible, or by pre-set control, so that the lighting for five scenes can be set beforehand and brought into operation immediately. R. G. H.

21. Floodlighting with Gas.

Gas Times. November 23, November 30, and December 7, 1935.

Contains (a) an illustrated description of gas floodlighting for the Centenary Celebrations at Dagenham; (b) an illustrated description of Lowestoft Hotel floodlighted by gas lamps; and (c) illustrated descriptions of the floodlighting of Exhibition House, Newcastle, and St. Mary's Church, Shoreham.

22. Caernarvon Castle Illuminated.

Anon. El. Times, 88, p. 398, September 26, 1935.

Photographs and a description of floodlighting by means of electric discharge lamps. W. R. S.

23. Illuminations at Chester.

Anon. El. Times, 88, pp. 283-284, September 5, 1935.

A set of photographs with an account of floodlighting effects at Chester, including floodlighting of water jets. W. R. S.

24. Computing Floodlight Installations.

R. J. Corfield. El. World, 105, p. 2,246, September 14, 1935.

The method of determining the area covered by a floodlight with circular beam is described. Formulae are given, and also a chart showing the dimensions of this area on a plane surface for a mounting height of 100 ft. for beam widths up to 45° and tilt up to 12° from the horizontal. Method of calculating illumination values is also given. S. S. B.

25. Stimulating Plant Growth.

F. E. Rowland. El. Review, Vol. CXVII., No. 3,019, p. 437, October 4, 1935.

A review of recent resarch into the effects of irradiation. The response of different plants to the types of light source employed, to the illumination and time of exposure has been investigated, and results are given. R. G. H.

Flashes

Light signals are recommended by the Ministry of Transport as an aid in the campaign against road accidents.

* * *

A Colombo neon sign with letters fifteen feet long is claimed to be the biggest in the East.

* * *

Plain lamp shades with all the interest centred on the stand—usually in the form of quaintly shaped animals—are selling in the West End.

* * *

Modern lighting fittings are the subject of a competition being organised in connection with the Paris Exposition of 1937.

* * *

Self-sustaining winches, for raising and lowering arc lights, etc., have been supplied by the London Electric Firm for the Queen Mary.

* * *

Architectural Lighting, Ltd., have increased their capital by £5,000 to £16,000.

* * *

Thirty-six 1,500-watt floodlights are used to light the Empress Hall, Earl's Court.

* * *

Major C. E. Prince has resigned from the board of Radiovisor Parent, Ltd.

Recent Patents

(Abstracts of recent Patents on Illumination & Photometry.)

No. 435,752. "Improvements in Gas-filled Electric Incandescent Lamps."

Dicker, S. G. S. (*Communicated by N. V. Philips, Gloeilampenfabrieken*), *February* 24, 1934 (*Divided from No.* 435,697).

According to this specification both leading wires of a coiled-coil filament gas-filled lamp are provided with fuses terminating in a thick layer of insulating material at the bottom of the lamp cap. The insulating material is sufficiently thick to prevent arcing between the ends of the fuses.

No. 435,697 relates to the use for fuses in gas-filled lamps of metals having a low "short circuit constant," such as nickel and its alloys, e.g., constantan, nickel-chromium, "Monel metal," "Konel metal," and the like.

No. 435,931. "Improvements in and Relating to the Operation of Electric Luminous Gas-Filled and/or Vapour-Filled Tubes and/or Lamps."

Fodor, J., and North, V. B., March 21, 1934.

This specification describes a system for energising luminous discharge tubes by means of electrodes fed with high frequency current and arranged upon a support or panel, to which the tubes are also attached, without conductive connection between the tubes and the electrodes, in which the electrostatic high frequency field due to the electrodes is produced in several sections by providing more than two strip electrodes running across the panel or support and embedded in the panel or support. The field strength at different points may be determined by connecting various different electrodes either directly, through a capacity or through resistance to each other, to earth or to the high frequency generator. The various electrodes may be connected to the generator through a high frequency transformer and different electrodes may be connected to different tappings thereof.

No. 436,221. "Improvements in or Relating to Electric Incandescent Lamps."

Lampe Yvel Auto-Lampe and Cie, Anciens Etablissements Léo Lévy et Alfred Monier. April 4, 1933, *May* 5, 1933 (*Convention, France: Cognate Applications*).

In order to minimise the dispersion and glare from motor head lamps and the like caused by fog, the envelopes of incandescent lamp bulbs are made of glass formed by melting a batch containing at least 0.25, preferably 0.45, parts by weight of cadmium sulphide and 0.15 parts of sulphur to 10 parts of sand. A particular composition of glass giving good results is set out in the specification. This glass has an orange yellow colour and cuts off quite abruptly from 0.55 micron wave length and shorter from the spectrum.

No. 436,469. "Improvements in and Relating to Controlling Apparatus for Electric Discharge Lamps."

The British Thomson-Houston Company, Limited, June 7, 1933 (*Convention, U.S.A.*).

According to this specification, the discharge is initiated in a discharge lamp by the discharge of a condenser, charged from the supply mains, through an auxiliary winding upon a choke coil connected in series with the lamp to limit the current. The condenser discharge may be governed by a grid-controlled discharge device, and the grid of the latter may be connected with a phase-control device to determine the point in the cycle at which the condenser discharges.

No. 436,664. "Illuminating Installation for Aerials."

Limited Company, formerly Skoda Works, Svoboda, J., and Raus, F. April 16, 1934.

According to this specification all parts connected with and carrying current for lamps on an aerial or mast are insulated throughout, and have small capacity to earth, so that they do not materially affect the high frequency properties of the aerial system, while choke coils, anti-resonant circuits, etc., are not required. An arrangement is shown comprising a generator mounted upon tall insulators and driven through a long insulating coupling by a motor.

No. 436,770. "Improvements in Electric Incandescent Lamps."

The General Electric Company, Limited, February 24, 1934. (*Convention, Germany.*)

According to this specification, a bulb for a head lamp or the like has soldered or otherwise affixed to its cap a washer or collar, preferably dished, which is of larger diameter than the lamp bulb, and fits in an orifice at the rear of the lamp reflector so as to position the lamp accurately and firmly in relation to the reflector. The lamp may thus be inserted from the rear and adjusted without risk to the polished inner surface of the reflector.

No. 436,894. "Capacity Operated Discharge Lamp."

Himmel, C. April 23, 1934.

This specification relates to discharge lamps with an external electrode operating by virtue of capacity current through the lamp envelope. The glass wall of the envelope is 0.4 mm. or less in thickness, and is preferably of glass, having a high dielectric constant to increase the capacity current at relatively low voltages and frequencies. The inner electrode is preferably provided with a highly electro positive coating, some of which may be transferred by sputtering to the inner surface of the glass.

No. 436,921. "Improvements in Electric Lighting Installations."

Colley, A., and Bryce, Limited. October 18, 1934.

This specification relates to lighting installations having alternative switching points for individual lamps. In order to economise in wiring and to avoid the use of double-pole switches, the lamp circuits, otherwise un-switched, are connected to electro-magnetically operated switches located on a distribution board. The electro-magnetically operated switches are such as to close and to open successively upon successive impulses of a low-voltage circuit. Low-voltage circuits for the several switches are respectively governed by alternative push-button switches connected in parallel with one another.

No. 436,967. "Improvements in or Relating to Illuminated Kerbs and Road Edgings."

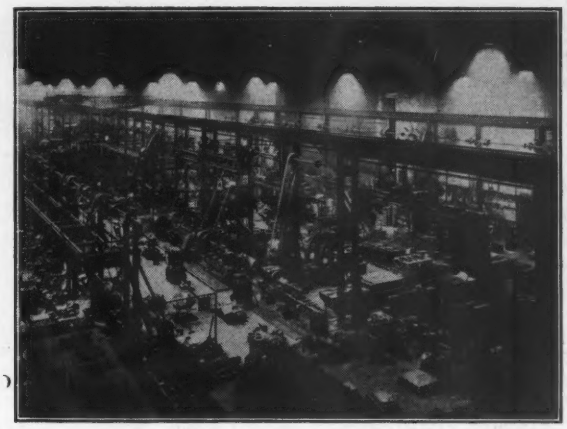
Hall, H. C. April 24, 1934.

This specification covers a kerb or road edging in which the outer face is directly illuminated by a light source located at the upper part of the kerb and directing light downwardly, the outer face being vertical and reflecting. The light source may be protected by an overhanging ledge, and may comprise neon or like luminous tubes.

PRACTICAL ELECTRIC DISCHARGE LAMPS

General Applications and Recent Advances

Notes on the paper on the above subject read by Mr. L. J. Davies (Research Laboratory, B.T.-H., Rugby) at the meeting of the Illuminating Engineering Society on Dec. 10, 1935.



[Courtesy: The British Thomson-Houston Co., Ltd.

A STRIKING EXAMPLE OF INDUSTRIAL LIGHTING WITH ELECTRIC DISCHARGE LAMPS.
The Machine Shop in the factory of Messrs. Broom & Wade, High Wycombe, illuminated by 48 electric discharge lamps in indoor dispersive type industrial fittings.

THE meeting of the Illuminating Engineering Society on December 10, when Mr. J. J. Davies had come down from Rugby to read his paper on Electric Discharge Lamps, proved to be a very attractive one. Everyone is watching the progress of these lamps, in which new developments have recently taken place, and in which others are promised in the near future.

The paper was illustrated by a series of most striking demonstrations. The thanks of the Society are due to Mr. Davies and his assistants for the great amount of trouble taken in fitting up these experiments, and to the Institution of Mechanical Engineers in providing facilities for them.

The paper consisted of three main sections, dealing with General Principles of Design, Applications, and Recent Advances in Technique.

Variety of Lamps Available.

The table reproduced below gives a summary of the chief types of lamps and their present applications. In his opening remarks, Mr. Davies explained that the scientific phenomena underlying electric discharges through gases are highly complex. The results of their application are evident in the varied types of lamps already available. To the high and low pressure mercury vapour lamps and the low pressure sodium lamps there must now be added the possibility of high pressure sodium lamps. There are, again, lamps in which the colour of the light is modified both by altering the contents of the tubes and by using coloured glass, and by making use of fluorescence effects. It is interesting to observe that the only gases at present used in practice are mercury, sodium, and neon. Of these, sodium is used as a high efficiency source regardless of colour and neon because it is a coloured light source of high efficiency for its particular colour. Mercury plays a dual rôle. Its complete visible radiation provides a light source of high efficiency, and its component lines, isolated by means of coloured glass filters, in addition form sources of coloured light of high efficiency. Mercury differs in that it is used over a range of pressures, while sodium and neon are always operated at given operating pressures, which have been ascertained, mainly by experiment, to correspond to optimum light output conditions in the two gases respectively.

TABLE I.—Summary of Electric Discharge Lamps.

Type.	Usual Fillings.	Main Use.
Cold cathode, cathodic glow Lamps	Neon.	Indicator Lamps.
Cold cathode positive column Lamps ...	Neon, mercury helium nitrogen.	Advertising.
Hot cathode (separately heated) Lamps ...	Neon, mercury.	Flood Lighting.
Hot cathode (Arc heated) Lamps	Mercury, sodium.	Street and Industrial Lighting.
Combination and Miscellaneous Lamps ...		Medical and Special Uses.

Effect of Higher Energy Levels.

Mr. Davies showed some interesting diagrams illustrating the effect on the light emitted by glowing gases by raising the "energy level" and thus influencing the behaviour of electrons. There is an optimum pressure of sodium vapour and a point beyond which increase in current can decrease the efficiency to such an extent that the total light output falls. The conditions in a mercury vapour lamp are quite different. As the operating pressure and lamp current increase the efficiency does not suffer, and the colour of the radiation improves.

A flat maximum is shown in light output at approximately 100 watts per cm. Above this the efficiency falls slightly but the percentage of red radiation in the light can be made to increase.

All these circumstances have an important bearing on the design of lamps and their possible ultimate efficiency. A high pressure is permissible in mercury vapour lamps; therefore relatively compact lamps are possible. The pressure in a sodium lamp is such that the volts per cm. are much lower and they are made of narrower tubing and in longer lengths. Furthermore, thermal insulating jackets must be provided. The auxiliary gear for lamps is also affected. Mercury lamps will start on voltages of 200 A.C. and only need a simple choke for stabilisation. The narrow tube of the sodium lamp requires a voltage of 400, so that a transformer to raise the supply pressure is usually necessary.

Of special interest is the effect of higher pressures and temperatures which—as seen in the super high pressure mercury lamp—profoundly affect the efficiency and quality of light. In the case of that lamp, apparently the energy in the ultra-violet ray region can be actually converted into increased energy within the visual spectrum, reinforcing the green and yellow and introducing a certain amount

of red (present in only a slight degree in ordinary discharge lamps and quite absent from the original low pressure mercury lamps).

Street Lighting With Discharge Lamps.

Applications cover a wide field—from advertising to medical treatment. Leaving out of consideration the so-called neon or cold discharge lamps, operating at about 1,000 volts per foot, the discharge lamps now considered are widely used for street, industrial, and floodlighting.

The first installations in streets, about three years ago, aroused much interest. The distortion of colour associated with such lamps is not important in street lighting. Much more important is the high degree of visibility attained. Such lamps should operate at not less than 35 lumens per watt. Typical characteristics which should be attained are illustrated in Table II.

TABLE II.—Characteristics of Lamps for Street Lighting.

Wattage (200-250 v.)	Overall Length.	Dia.	Light Centre Length.	Average Current.	Typical Lamp Voltage Drop.	Initial Luminous Efficiency.
	mms.	mms.	mms.	V.	A.	lumn/watt
400	325	51	190	3.1	140	45
250	290	51	170	2.0	140	36

Industrial Lighting.

The lamps may be used in any industrial situation in which two characteristic features do not clash with the requirements of operations in the particular factory. The two characteristics are the colour of the light and its cyclical variations in intensity over the alternating current cycle. There are very many cases in which correct appearance of colours or colour-matching are of no consequence and for these the lamps are already widely used. In some cases, indeed, the concentration of light in the green and yellow seems to be a positive advantage—for example, in the examination of sheets of metal and castings, in coal sorting, bus cleaning, etc. The production of stroboscopic effects when rotating machinery is viewed by the light of the lamps deserves more consideration, but the effects are not nearly so marked as is sometimes supposed.

Stroposcopic Effects.

Very striking effects can, however, be produced by deliberately achieving synchronism. Some very pleasing experiments were contrived by Mr. Davies and applauded by the audience. One recalls particularly some discs bearing apparently indefinite patterns, which, when the discs were revolved by the light of the discharge lamps, took on various rhythmical forms, and at one particular frequency formed themselves into the letters "I. E. S.," which remained stationary. In the course of the demonstrations the author also showed a new device based on the combination of a hot cathode mercury vapour lamp, and a 60 m.f. condenser which emitted flashes of light of a duration of less than 1/20,000 of one second—a device likely to prove of great value for the examination of moving machinery.

Floodlighting Effects.

In this field the variety of colours available from the use of mercury, sodium and neon and the high efficiencies attainable are great advantages. The natural light from the high pressure mercury lamp seems to suit many types of surfaces, and especially buildings of grey weathered stones. But by the aid of filters many delicate shades of colour can be gained, as illustrated in Table III.

TABLE III.—Colour and Efficiency.

(Overall Efficiencies are given, including any losses in auxiliary gear.)

Colour of Light.	Lamp.	Efficiency. l.p.w.
Light blue	L.P. Mercury	12.0
Very light violet	H.P. „	26.0
Light blue	H.P. „	11.0
Med.	H.P. „	7.0
Light green	L.P. „	12.0
Dark green	L.P. „	9.0
Very pale green	H.P. „ (Used without filter)	42.5
Light green	H.P. Mercury	13.0
Med. green	H.P. „	10.0
Yellow	Sodium	38—45
Yellow green	H.P. Mercury	16—28
Pale yellow	H.P. „	18.5
Red	Neon	9.5

(For the above colours the efficiency of tungsten lamps plus filters is from 3 to 8 l.p.w.)

Some Recent Advances.

In this connection the 100-130 volt high pressure mercury lamps mentioned by the author might well be included. By adopting special methods of raising the initial cathode temperature lamps that will start on voltages as low as 70 a.c. and at temperatures as low as 20° C. have been produced.

Another advance is the lamp for the study of moving machinery mentioned above.

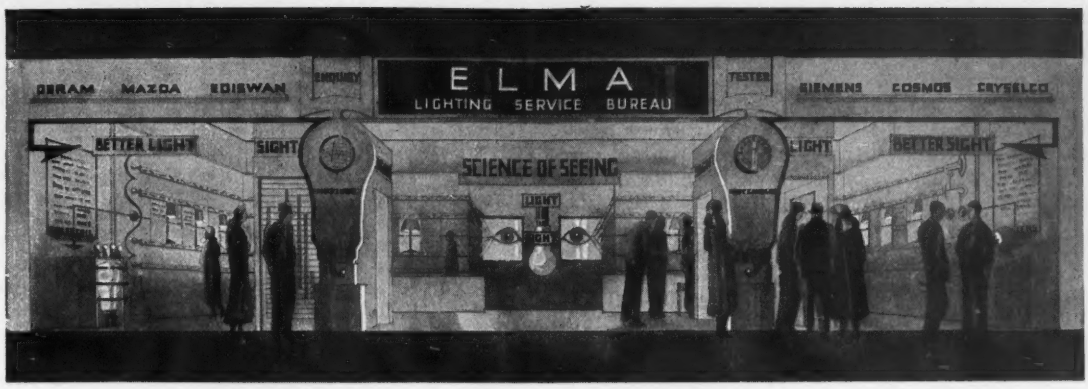
Other advances have been the production of lamps to burn horizontally, and the introduction of colour-modified lamps—the improvement in colour naturally involving some loss in efficiency.

A very outstanding development is the new super high pressure mercury lamp, which was first demonstrated at the opening meeting of the Society in October last and was again dealt with by Mr. Davies.

Finally, some beautiful experiments were shown by Mr. Davies illustrating the presence of ultra-violet radiation in the spectra of electric discharge lamps, and the use of fluorescent powders to convert such radiation into a visible form—a device which renders possible the production of light of many vivid and unusual colours.

MODERN BEDROOM LIGHTING

A Bedroom in a Leicester Residence lighted by nine pink and white Mazda Light Tubes arranged over mirrors, etc., on the walls.



THE E.L.M.A. "SCIENCE OF SEEING" EXHIBITION AT CHARING CROSS.

The picture above illustrates the appearance of the recent "Science of Seeing" Exhibition arranged by the E.L.M.A. Lighting Service Bureau at Charing Cross (Underground) Station, London. When it is remembered that about 500,000 people are estimated to pass through Charing Cross during a fortnight (the period of the exhibition) the value of such a display in impressing the public is evident. A leading feature of the display was the "Light-Sight Tester," enabling people to determine for themselves how much light they need for comfortable seeing. Specimens of the new Study Lamps were also on view. Mr. R. O. Sutherland, A.R.I.B.A., the Architect to the Bureau, was responsible for the general design.

THE SCIENCE OF SEEING

by

W. J. JONES

Notes on an Address delivered before the North-Western Local Section of the Illuminating Engineering Society on Tuesday, November 26, 1935.

IN the course of an address delivered before the North Western Local Section of the Illuminating Engineering Society on November 26, Mr. W. J. Jones commented on the need for a wider outlook on the part of those experts who are apt to rely exclusively on physical concepts of lighting. Persons concerned primarily with the art of producing lighting effects are sometimes apt to dismiss too lightly the value of calculations in terms of foot-candles, lumens, etc. But most certainly such technical data do need to be related to the impressions formed by the eye and the reactions of the mind.

What has settled the limitations of artificial lighting in the past? Doubtless, as Mr. Jones remarked, the limits have been mainly economic. The standard has been based on avoidance of the "grumble point," without going very far beyond it! Now that our facilities for producing and distributing light are so much more generous than in the past the engineer should think of lighting standards which will enable mankind to see with facility and to bear in mind the handicaps to vision which result from lower values.

Members of the Illuminating Engineering Society have a responsibility to fulfil in keeping the public advised of modern progress in lighting, which has been profoundly influenced by the attention which physiologists are now devoting to the lighting problem.

Ease of Seeing

The eyes are the doorways of light and represent the main channel between the external world and our inner consciousness. Seeing is a partnership of Light and Vision. Instead of specifying foot-candles on an empirical basis or on what we have been accustomed to think we can afford the choice should be an expression of physiological need. The period of vision by artificial light is of but short duration—whereas eyesight is as old as mankind itself—according to some authorities at least 100,000 years.

Consider the following simple facts:—

For over one thousand centuries the eye evolved under the high intensities of daylight.

For over one thousand centuries eyes were used mainly for viewing distant objects.

Only during the last century has mankind worked under artificial light.

To-day we have close vision and exacting visual tasks undertaken for long periods.

During this long period of development the eye was gradually perfected for the casual viewing of comparatively large objects under the high intensities of daylight. For many years architects have concentrated on improving the standard of daylight in buildings. In the early days window-openings were restricted owing to the cost of glazing, and there are still to be seen in this country instances of the effect of the window tax in limiting their size. Great improvements in methods of admitting daylight are to be found in modern multi-story offices and factories. Yet, even in such circumstances daylight may be abundant near a window, but insufficient some distance away. Near the window there may be 100 foot-candles but a few feet away only 20—30, and in the corners of the room 10 or fewer. Hence people automatically take up positions near the windows when reading or sewing in the daytime. In houses the movement towards more spacious windows serves admirably those members of the family who are at home during the daytime, but many homes are only occupied by most of their members after five o'clock in the evening. Children are away at school and the breadwinners at work during the principal hours of daylight.

Taxing the Eyes at Night

It is, therefore, in the evening hour that most use of the home is made. Yet when we consider present values of lighting at night we see how far we have strayed from Nature's plan. We must also remember that whereas outdoor preoccupations rarely call for the focussing of attention on objects held at arm's length the child in school, the college student, the office worker, and the business man spend many hours each evening with the eyes focussed on papers and books all held viewed at the distances of 12 to 16 inches. Outdoor occupations mainly involve distant vision looking out into space; indoor occupations

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call for a constant turning in of the eyes—a further deviation from Nature's plan.

Insufficient Illuminations

The low order of illumination still customary in the case of artificial light—so very much lower than the values usual during the day—accentuates the effect of so much near vision. The facts that the percentage of defects of vision amongst children steadily increases during school life, and that thereafter the eyesight of adults tends to deteriorate during a period when the mind and body continue to develop and improve, surely constitute a challenge—they indicate that man has not successfully altered Nature's plan.

Effect of Size and Contrast

In the latter part of his lecture Mr. Jones emphasised the part played by the size of an object and the contrast between the brightness of the object and its surroundings in determining the amount of illumination needed. He quoted the recent research by Mr. H. C. Weston in showing how intimate a relation exists between the requisite illumination in foot-candles and the angle sub-tended at the eye by the detail examined, and in particular as suggesting that illumination intensities of the same order as those met with in daylight are necessary when very small things are to be examined. He explained how the mere fact that an object dark in colour effect implies that a higher illumination is needed, and how a black thing against a dark grey ground is necessarily much more difficult to see than when the background is white—a difficulty that can, however, be partially corrected by furnishing higher illuminations. In this connection he presented figures to illustrate the variation in eyesight with age in various industries, pointing out that as age increases the need for good lighting becomes more and more imperative.

Quickness of Vision

The above factors have no doubt an important influence in deciding the speed with which things can be seen and recognised. More generous illumination is specially effective in improving speed of vision and increasing the rate of carrying through visual tasks. In this connection Mr. Jones explained the working of the now familiar "Light-Sight Demonstrator" which enables anyone to decide for himself the intensity of illumination he prefers for ordinary reading—or alternatively can be used to show the advantages of higher illuminations for the examination of various processes or types of material. He also referred to the recent experiments of Luckiesh and Moss who have found that the effort of reading is revealed by a diminution in the rate of heart beats—a diminution, however, which becomes progressively smaller as higher illuminations are furnished.

The Study Lamp

We have received from Messrs. Siemens Electric Lamps and Supplies, Ltd., the above illustration of the new "Study Lamp," which is the outcome of the "Science of Seeing" investigations of the E.L.M.A. Lighting Service Bureau.

This standard form of lamp, eliminates the defects so frequently found in portable table lamps and provides:—

(1) Sufficient illumination on the table.

(2) Well balanced light distribution for the avoidance of sharp contrasts in and about the room.

(3) Complete absence of glare.

These results are achieved by careful proportioning of the parts of the lamp and selection of means of diffusing the light. A 100 watt Pearl "coiled-coil" lamp is used and is encircled by a diffusing cup, which, in conjunction with the reflection from the interior of the shade, smooths out any possible inequalities of light and gives a soft diffused effect. An important feature in giving uniformity is the height of the standard (19 in. from base to lampholder). Light emerging through the aperture at the top of the shade gives mild brightness to the surroundings.

SIMPLEX

Industrial, Commercial & Street Lighting Shopwindow

REFLECTOR FITTINGS

SCIENTIFICALLY DESIGNED

SIMPLEX ELECTRIC CO., LTD.

Head Office: 159, GREAT CHARLES STREET, BIRMINGHAM, 3

"LUX"

(La Revue de l'Eclairage)

WE have pleasure in announcing to our readers that we have entered into an arrangement to receive subscriptions for the French Journal "Lux" (La Revue de l'Eclairage). The subscription per annum is 30 francs, the approximate equivalent of which in English money is Seven Shillings and Six Pence (7/6).

"Lux" is the only French journal which specialises in all aspects of lighting; it is the official organ of the Association Française des Ingenieurs de l'Eclairage (equivalent to the Illuminating Engineering Society in France).

It furnishes a complete record of interesting developments in lighting in France and on the Continent. It is fully illustrated and in particular devotes a considerable number of its pages to Decorative Lighting.

By studying these articles and the numerous photographic reproductions of modern lighting installations the reader can readily gain an excellent impression of French methods and practice in matters of Illumination.

Applications for subscriptions will be received by "Light and Lighting," 32, Victoria Street, London, S.W.1.

"Playing for Safety and Safety for Playing"—this is the title to a recent note in *The Reflector*, issued by the Benjamin Electric, Ltd., to whom we are indebted for the adjacent illustration. Education Authorities are to be commended for their enterprise in throwing open school playgrounds so that children can play in safety there instead of in the streets. But at this season of the year the value of the privilege is lessened by the short daylight hours. The picture of an L.C.C. school playground lighted by Duoflex floodlights shows how easily artificial light can be provided.

From *"The Reflector"*

FLOODLIGHT THE CHILDREN'S PLAYGROUNDS!

A Necessary Addition to the Action of the Education Authorities in throwing open School Playgrounds for Recreation after School hours.

Mazda Tube Lamps and The Automobile Industry

It could probably be said with truth that the general use of tubular "architectural" lamps has been one of the chief features in decorative lighting of the past year. Their use in schemes of architectural lighting is familiar, but they are now also being used in continually increasing number for display purposes. An instance is afforded by the window of the Drill Hall Garage and Showroom, Blackburn, shown above, which is outlined in Mazda light tubes.

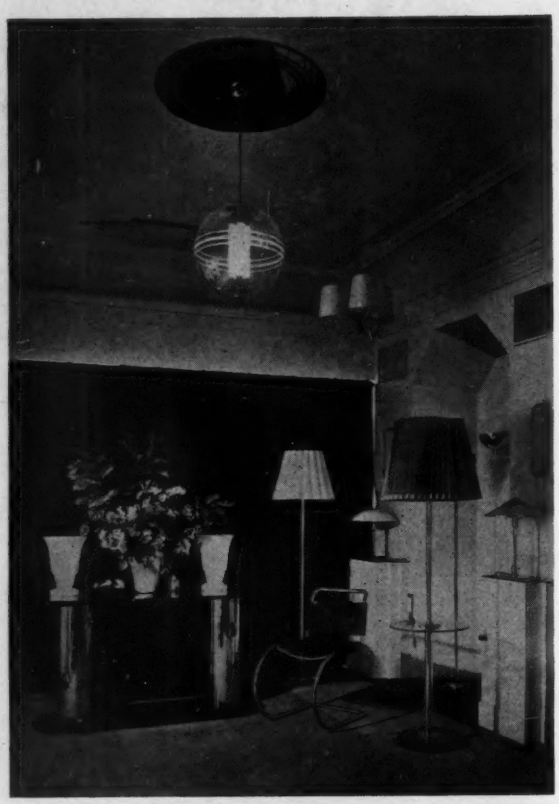
Lighting a B.B.C. Studio

The installation shown in the picture above is the outcome of a Holophane installation at the National Broadcasting Studios, New York City, which proved to be highly successful. In the application of similar methods to the B.B.C. (No. 3) Studio at Maida Vale, London, "built-in" flush ceiling units, each square ceiling unit comprising four Holophane concentrating prismatic plates, are used. Over each plate is a 100-watt lamp and a special hemispherical reflector. The units are arranged in three rows with 12-ft. spacing. An illumination of over 10 foot-candles is provided.

The Lighting Centre

A Visit to the Showrooms of Messrs. Troughton & Young, Ltd., at 143, Knightsbridge, London, S.W.1.

A recent visit to the remodelled showrooms of Messrs. Troughton and Young ("The Lighting Centre"), following the official Press visit, gave one a chance of inspecting in a more leisurely way some of the most distinctive types of fittings with which this firm is identified. Broadly their aim might be said to be the combination of originality in design and pleasing appearance with good qualities from the standpoint of the illuminating engineer. By the latter is meant not so much extreme "efficiency" (which is often impossible to compass in designs of beauty)



A section of the Main Showroom with an original Pendant fitting in the foreground.

as conditions which are restful to the eye and, more especially, absence of glare.

The range of fittings is broadly divisible into two classes, to each of which a special catalogue has now been allotted, those of an essentially decorative type and the now familiar "Ultralux" models in diffusing glass. Amongst the former several distinct lines of design may be distinguished. There are, for instance, essentially indirect types, of which the pleasing chromium plated bowls with one or more luminous bands are examples. There are others which recall the planet Saturn, with bands encircling a central luminous sphere or (as in the picture above) a central cluster of tubular lamps. Tubular lamps, again, lend themselves to a distinctive group of models. There are

The Special Section where "Ultralux" fittings are on view.

also modernistic fittings consisting primarily of combinations of shining metal and translucent glass discs, plates or pyramids. Finally, there are fittings showing a return to conventional design but with a modern twist to them!

The Ultralux range of fittings which appeal specially for domestic use have a section to themselves just beneath the staircase. This conducts the visitor to the upper floor where yet another division in modern lighting equipment, that based on the use of extensive luminous panels for laylights, niches, etc., is illustrated. At the foot of the staircase one was shown an ingenious device—the use of a spotlight to cast a luminous image fitting over a section of a picture featuring Ultralux fittings—a method of reinforcement that seems likely to become popular in the modern showroom.

Flashes

A £60,000 lamp factory will be built at Glasgow by the Scottish Co-operative Wholesale Society.

* * *

The Imperial Continental Gas Association seeks Parliamentary authority to produce electricity in Great Britain and Northern Ireland.

* * *

The date for the Illuminating Engineering Society's official visit to the Birmingham Section of the British Industries Fair has been provisionally fixed for Tuesday, February 25.

* * *

Loughborough Council is considering a scheme for improving the town's street lighting.

* * *

Christmas trees decorated with coloured lamps were erected in public squares and gardens in Margate, Westgate, and Birchington.

* * *

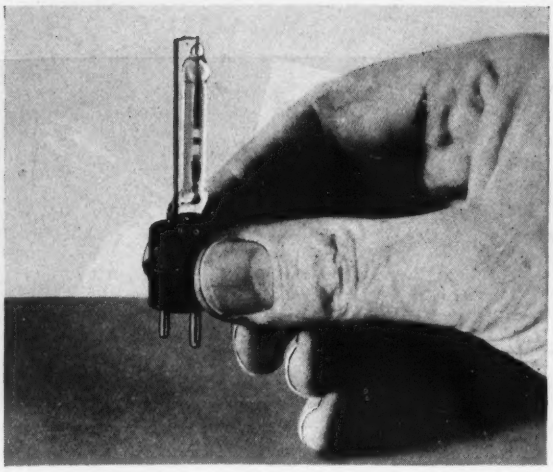
The contract for the maintenance of the sea-front neon illuminations at Brighton has been placed with Ionlite, Ltd.

* * *

Electric lighting in a house from which the meter had been removed four years ago led to a sentence of a month's hard labour for an ingenious Birmingham householder.

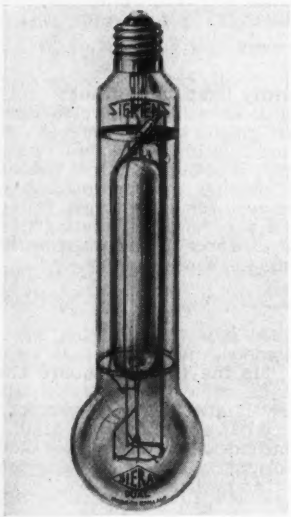
* * *

Since 1931 electric lamps in mines have increased by 10.655. The proportion of cap-lamps to electric hand-lamps is now 1 to 9.



A Wonderful New Lamp. It can be held between the finger and thumb and furnishes nearly 10,000 candle-power per inch.

A Snapshot, taken in 1/25 sec. by the light of a New Photographic Lamp and shown on the lantern screen half-an-hour afterwards.



A New Lamp combining an Electric Discharge Tube and Filament within the same Bulb.

SOME OF THE NEW THINGS SHOWN AT THE OPENING MEETING OF THE ILLUMINATING ENGINEERING SOCIETY.

Wouldn't You Like To Join?

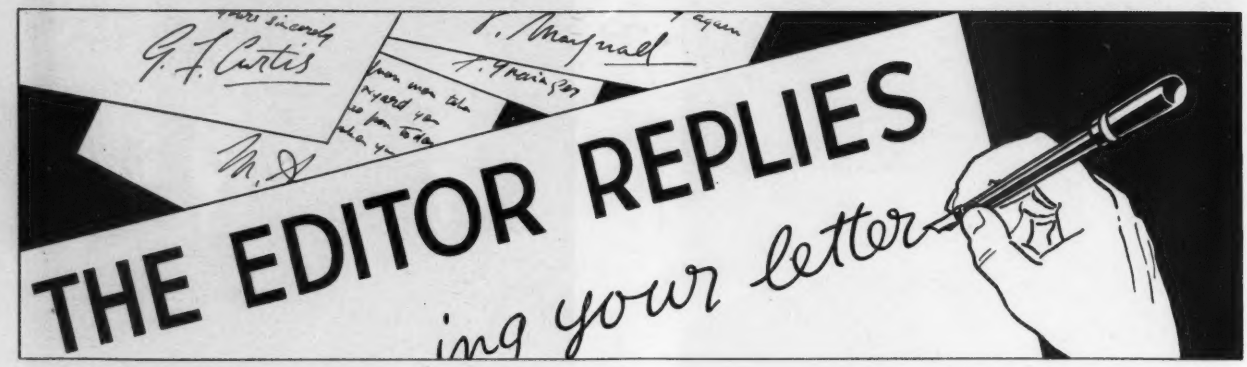
Anyone Interested in Lighting is eligible to apply for Membership.

Full Particulars from the Hon. Secretary, 32, Victoria Street, London, S.W.1

A New Boundary Light for Aerodromes.

A New Instrument for measuring the Brightness of the Roadway.

A New Type of Gas Lamp recently introduced in the streets of London, which uses a mantle in the form of a rectangle instead of the usual cylindrical shape.



We invite from our readers Inquiries, Particulars of Problems or Comments on Matters of Public Interest. We will gladly give publicity to topics likely to interest our readers, but we fear we cannot entertain lengthy expressions of views in parliamentary language. Space is limited, and type is not compressible!

As a commencement to this new section it may be interesting to survey a selection of the inquiries received during the past few months. Many of these—as the title of the section suggests—come by letter. But nowadays the Editor's leisure is not encroached upon only by his post bag. Many problems are raised in conversations with callers, and, of course, the telephone provides a running accompaniment to his efforts to compose articles! We shall draw on all these sources of inquiry. And now, as Mrs. Boffin once said, "The Horses are Off!"

Perhaps the most frequent subject of inquiry is **Electric Discharge Lamps,** e.g., in regard to life and efficiency. The difficulty here is the march of progress. Experiences of only a year ago do not apply now. But we may recall the statement in the I.E.S. Annual Report of Progress (Illum. Eng., December, 1935, p. 410), that a 400-watt lamp should yield initially 45 lumens per watt, and, during a life of 1,500 hours, should have an average output of 37 lumens per watt. These figures would no doubt be endorsed by makers of lamps, and they are broadly confirmed by data that have reached us from public lighting engineers. Some lamps last very much longer than the period specified, but it is a matter for consideration what should be the "scrapping point."

We have also been asked questions about **"Combination Units"** containing several filament lamps and an electric discharge lamp within the same fitting. Mr. G. H. Wilson's paper before the A.P.L.E. at Margate, in 1933, suggested that, for colour-correction purposes, it was not worth while adding filament lamps of less than half the wattage of the discharge lamp, and that equality in wattage represented the expedient upper limit. It has also been asked what happens to such combinations in the event of a momentary failure of the electric supply. Electric discharge lamps will only start when "cold." Will the adjacent filament lamps, when relighted, maintain the temperature of the discharge lamp and prevent its starting up? Experience seems to show that any possible delay would not exceed half a minute, and that the danger is negligible. (Readers will not, of course, forget that in the new Sieray-Dual lamp a filament and a discharge tube in series are now included within a single outer bulb.)

Interest has likewise been expressed in the new **"Supervia" Gas Lamp** with a strip mantle in place of a cylindrical one. We were asked some time ago for figures in regard to maintenance. Is the life of such mantles less, and are they more costly to maintain than ordinary ones? It is a little early to give definite figures, but we believe that the experience of the South Metropolitan Gas Company in regard to high-pressure units is that the comparison is, if anything, rather favourable to the new type of mantle, whilst in the case of low-pressure lamps there is also very little difference once the mantle is up. We have been told, however, that experience in regard to mechanical breakage is rather variable—the fact being that, amongst users to whom the mantle is a novelty, it is not infrequently passed from hand to hand before erection and is apt to suffer in the process!

We often aid readers to **identify lamps and fittings**—not a few of which could be traced at once in "Where to Buy." We have, however, recently given information to the effect that the "K-Ray" picture lighting equipment (which also serves for illuminated signs) is obtainable from Linolite Ltd., and that the "Ultralux" fittings are the product of Troughton and Young. There have been some special fittings (usually ending in "-lite" and apparently emanating from abroad) which we have failed to trace. In future when we do so we shall appeal to readers in these columns.

Amongst queries of a photometric nature we may recall one that is a hardy annual, **"Is the Inverse Square Law Always True?"** The answer is, of course, that for light radiating from a point the law is **always** true—even for a searchlight so long as the source has any magnitude at all.

(We occasionally have submitted to us reflectors or other devices whose estimated performance is so good as to defy the law—but they are too good to be true.)

For masses and combinations of point sources the law may **appear not to be true,** but only because of uncertainty or difficulty in determining the exact positions of sources and their distance from the object illuminated, or in judging their combined effect. We propose to make this question the subject of a special explanatory article.

A kindred problem is that of estimating the effect of **long tubular sources of light,** either their illuminating power or brightness. This really comes under the heading of a comprehensive investigation now being pursued by the I.E.S. Technical Committee, whose report should not now be very long delayed. But in the meantime perhaps some members have rough-and-ready ways of their own? (Now then, Mr. Beuttell!)

There is one query that is always with us, and that is in regard to **Jobs.** The course of events unfortunately so often justifies the poet's complaint, "Never the time and the place and the loved one, all together!" When (as often happens) we learn that someone needs a job, the job is not in sight. When (less frequently) application is made for someone to fill a post, one cannot at once put one's finger on the man. Nevertheless, we can say truly that in almost all cases job and jobber are ultimately brought in contact. Therefore let readers by all means continue to send us requests for both commodities.

One might perhaps conclude by mentioning a type of inquiry that one can hardly answer. It was typified by the lady who rang up the editorial office on the telephone and hoped, for the expenditure of 2d. and within the permissible three minutes, to extract a complete scheme for the lighting and wiring of her home. It can't be done.

TRADE NOTES AND NEWS

Catalogue of Lighting Accessories

Automatic Ignition of Public Lamps

One of the most interesting stalls at the Public Works Roads and Transport Exhibition was that of the Horstmann Gear Co., where the new "Comet" automatic ignition device for use with clock controllers was on view. By applying the distinctive electric and catalytic which the company has developed the period during which a by-pass flame is needed can be made minute, i.e., only for the few seconds during which the lighting up is effected. It need not in fact exceed more than 0.0005 cubic feet per day—which manifestly means a substantial saving in the course of the year.

As usual a very full range of models for automatic time-control switching for shop windows, sign lighting, etc., as well as streets was shown; also the now familiar Newbridge gas switch for the distance control of domestic lights and the Newbridge gas fire switch. The latter, which has some features new to the writer, was impressively simple in action. We were also impressed by the effective "pistol" lighter which seems as foolproof as anything possibly can be—in fact it was dashed on the floor and kicked severely for our benefit, without apparently suffering at all!

Making the Kerb Visible

It has often struck us, considering the importance which motorists attach to seeing the kerb, that more might be done to render it visible. The "Hailwood" kerbstone reflectors, illustrated below, are worth study from this standpoint. The cat's-eye lens, with a funnel mouth, enabling the lens to be set well back either straight or in line with the kerb, catches the light from incoming headlights so that the course of the kerb can be followed with ease at bends of the road. The device is quite a simple and inexpensive one. Another Hailwood device takes the form of illuminated hinged sections, which are fitted with traffic yellow or red glass panels and lamp-holders, and are folded round ends and noses of island platforms, with the result that the outlines of the platform are clearly seen at night.

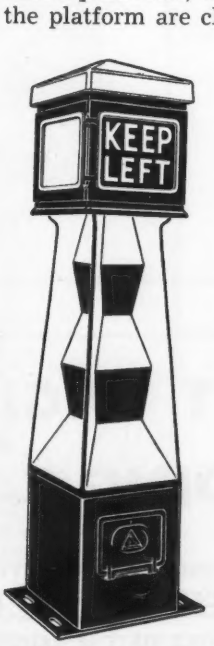
"HAILWOOD" KERBSTONE CATS-EYE FUNNEL-LENS REFLECTORS
BRIT. REG^D. N^o. 807108

Sentries of Traffic

To the uninitiated one illuminated guardpost may seem much the same as another, but in fact there is a great advantage in a neat design, brightly and evenly illuminated and easily maintained, such as could be seen in variety at the stall of Gowshall, Ltd., at the exhibition mentioned above.

We reproduce herewith two which caught our fancy. "The White Duke" has strong supporters, but for our part we have a weakness for the graceful lines of "The White Lady." The "Black and White" design, prepared in collaboration with Walter Macfarlane and Co., strikes a bolder note and is bound to catch the eye.

The "White Lady."



"Black and White."

Electric Discharge Lamps on the Southbury Road

An installation of sixty-six Ediswan "Southbury" lanterns fitted with 400-watt Escura electric discharge lamps has been introduced on the above road which connects Enfield Town and the Hertford Road. The one and a half to two miles of roadway is very evenly lighted, and the high surface brightness is attained with a minimum of glare, owing to the limit set to the intensity at angles between 80 degrees and 90 degrees to the vertical. The same method of lighting has been applied to the adjacent four miles of the Hertford Road and to Church-street, Enfield.

New Lighting of the Restaurant of Messrs. Stagg & Russell, Ltd., Leicester-square, London

This pleasing scheme was successfully carried out by the electrical staff of Messrs. Stagg and Russell, under the direction of Mr. A. W. Jervis, the chief engineer. A feature is the use of Siemens' architectural lamps in surroundings which are distinctly modern in outline. The circles, semi-circles, and quarter-circles of light form a decorative motif, resulting in ample and well diffused illumination. Supplementary lighting is afforded by Siemens' yellow-sprayed 200-watt lamps, which are mounted above the ceiling lay lights.

A view of the restaurant of Stagg & Russell, Ltd.

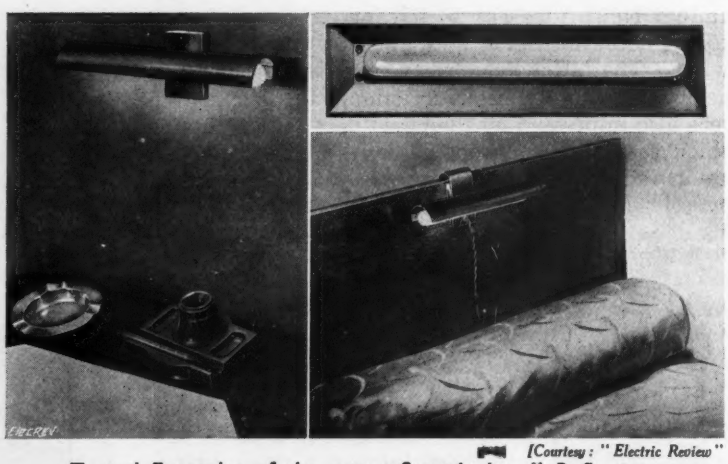
"Floralite" Illuminated Flowers

The picture below illustrates a novelty for which the British Electrical and Manufacturing Company are responsible. "Floralite" consists of life-like reproductions of flowers, in each of which is concealed a minute electric lamp so that the whole basket glows with a soft radiance. It can be connected to any a.c. supply, and the running cost is negligible. No doubt it has done good service during the recent festive season, and will continue to prove of service in theatres, cinemas, restaurants, and ballrooms, etc. Besides the baskets illustrated the idea can, of course, be applied in other ways.

New Straight-Lite Reflectors

We illustrate below some of the new models of "Maxtrip 2" lamps produced by Straight-Lite Reflectors, Ltd. Special interest attaches to the single-light desk or wall unit, which is suitable for a wall-bracket reading-lamp (No. 210). Another design (No. 211) is similar, but is intended mainly for use in conjunction with mirrors and as a bed light. Other types suitable for architectural lighting design have been developed, amongst them being a one-light wall unit, the outer frame of which is finished in polished chromium plate, whilst the bottom contains white flashed opal glass.

A Pleasing Floral Device.



[Courtesy: "Electric Review"

Typical Examples of the new "Straight-Lite" Reflectors.

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Floodlighting at Bournemouth

The effect of floodlighting in emphasising certain architectural features is rather strikingly illustrated in the adjacent picture of the Palace Court Hotel, Bournemouth, which, in common with a number of other hotels in Bournemouth, has been illuminated by means of electric discharge lamps giving coloured light. This is a modern type of building between 80 and 90 ft. high. Seven G.E.C. floodlights fixed above the canopy at first-floor level at a distance of 4 ft. 6 in. from the face of the building are used. Messrs. Aish and Co. were the electrical contractors responsible in this case, and likewise in the case of another building of quite a different character, the Harbour Heights Hotel. The chief feature of the floodlighting of the Palace Court Hotel, here illustrated, is the manner in which the horizontal lines of the building —very popular with architects at the present time-- are accentuated.

The Palace Court Hotel, Bournemouth, Illuminated by Osira Lamps.

Useful Photographic Lamps

The "Sashalite" Lamp.

The Osram Photoflood Lamp.

Two useful lamps for photographers are shown above. The "Sashalite" lamp shown on the left is now familiar to professional photographers, but deserves to be more widely known to amateurs. The great merit of the lamp—as compared with flash powder—is that noise, concussion, smoke, and fumes are all eliminated. It can be used both indoors and outdoors, and in places where, owing to possible danger of fire or explosion, the use of flash powder would be forbidden.

The Osram Photoflood lamp, shown on the right, is a more recent introduction. The filament is considerably overrun in order to get high actinic value, but the lamp need only be switched on for a very short interval of time. It can be used on mains with voltages of from 100 to 250.

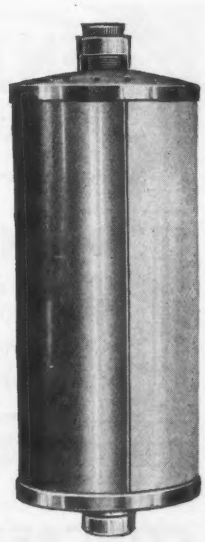
Both lamps are products of the General Electric Company, Ltd.

An Attractive Bedlight

A very simple but effective type of bedlight has recently been introduced by Messrs. Falk, Stadelmann, and Co., Ltd., and is illustrated below. The device is cylindrical in shape, the cylinder being glazed over only one-third of its circumference, leaving the remainder in polished metal. The glazed portion receives light from a 25-watt lamp (no higher wattage is necessary) and the diffused glass, being evenly illuminated, gives a soft light which is ample for two beds if the unit is symmetrically placed between them. By turning the cylinder (which rotates on its axis) slightly in either direction, one bed can be thrown into darkness whilst the other receives the full light.

If the illuminated area is turned to the wall the lamp serves as a night light; or it can be used as a shaving mirror. In fact. it has many uses. It is entirely British in manufacture.

Showing diffusing glass area exposed in front.



Showing diffusing glass area turned to give light sideways.

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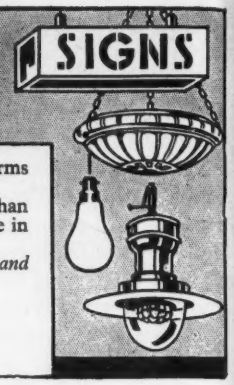

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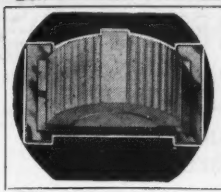
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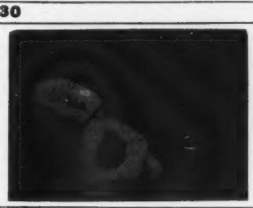
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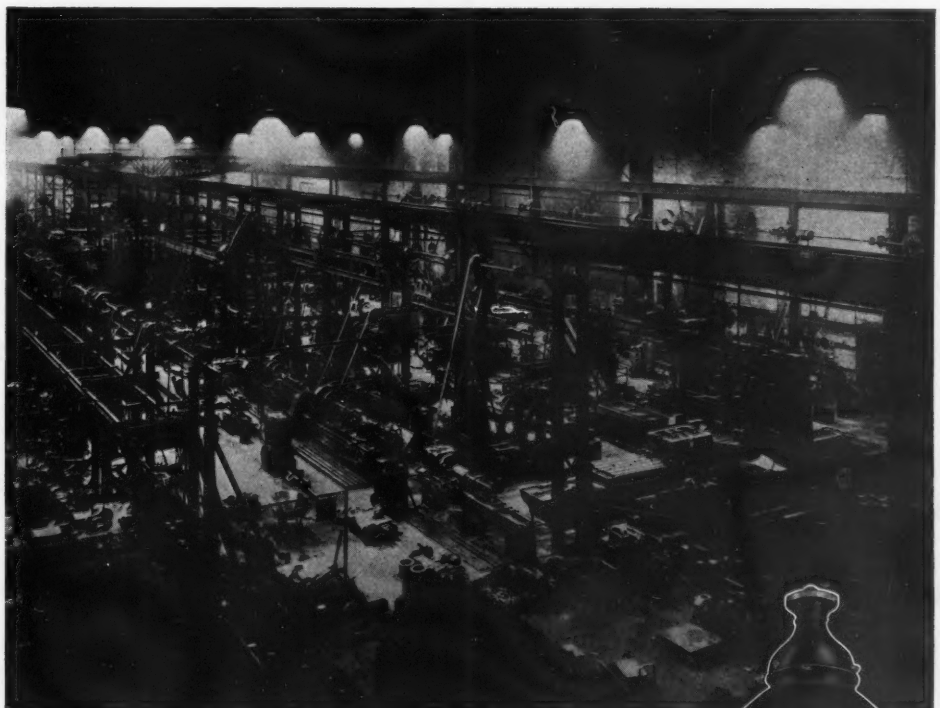

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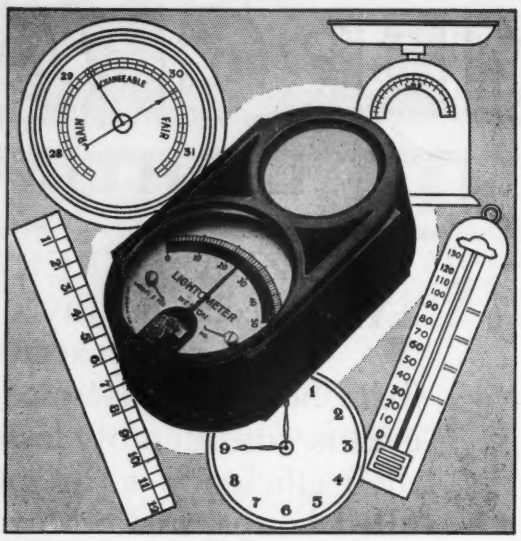

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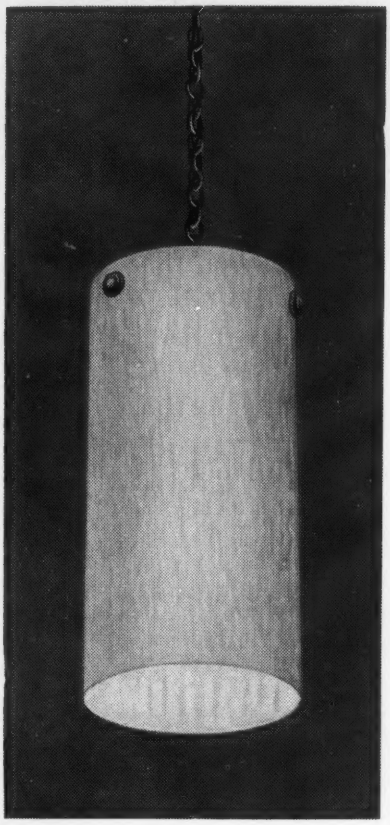

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